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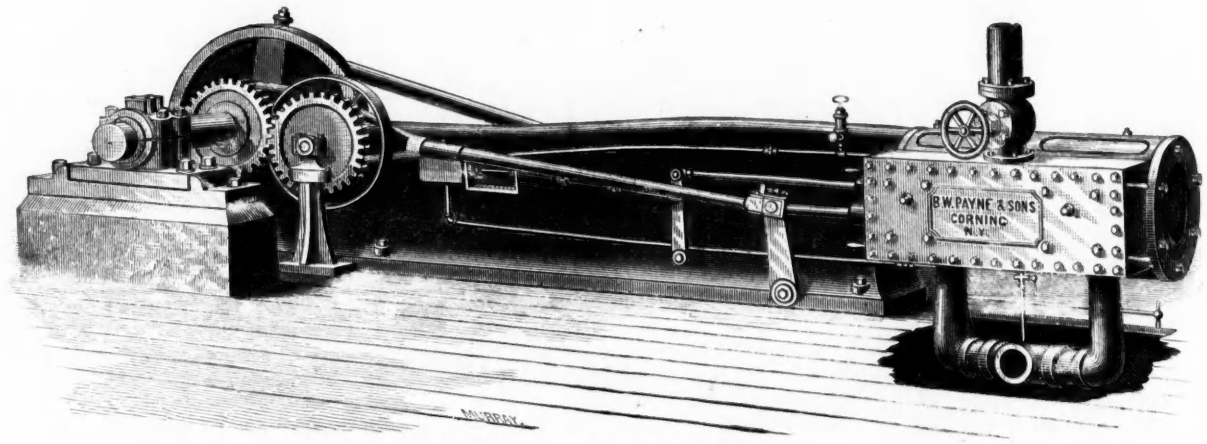
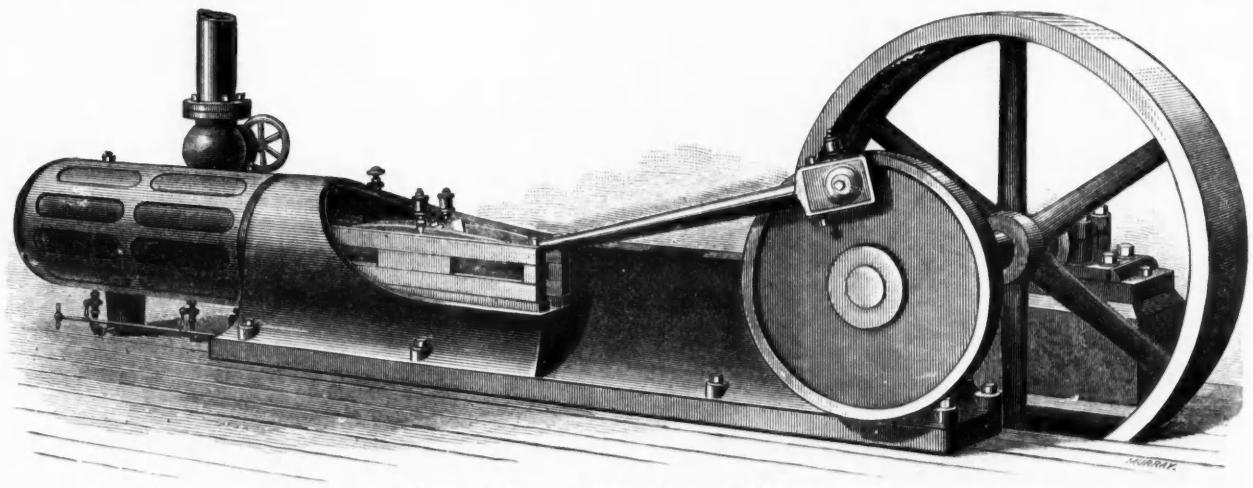
New Automatic Cut-Off Steam Engine.

The two engravings upon this page represent the front and back views of a new automatic cut-off steam engine recently built by B. W. Payne & Sons, of Corning, N. Y. The bed is of the most substantial design, to which is attached an overhanging cylinder of 10″ diameter and 20″ stroke, built to run at a speed of 180 revolutions per minute. This arrangement prevents any trouble from unequal expansion, and also admits of replacing the cylinder with a new one when desired; also, of easier transportation where space is an important consideration. The crank is of the disc form, in which the reciprocating parts are counterbalanced, so as to accomplish the best results. The crank-pin end of the connecting rod is made solid, the boxes being adjusted by means of a wedge. The guides are heavy, and, having blocks between them, can be adjusted as the cross head wears.



BACK VIEW OF NEW AUTOMATIC ENGINE.

The back view of this engine shows the general arrangement of the valve motion, which is the invention of Harris Tabor, and the principal peculiarity of this engine. The fly wheel in this view has been purposely omitted to show the governor and shaft connections; likewise the floor broken, to show arrangement of exhaust pipes. The valve motion consists of a main slide, balanced by the application of pressure plates. This valve is operated by a direct connection with a fixed eccentric upon the engine shaft; therefore, the travel of the main valve is always the same, giving constant lap and lead



FRONT VIEW OF NEW AUTOMATIC ENGINE.

There are exhaust ports at each end of the cylinder, so that the exhaust steam is quickly conveyed away, avoiding the usual condensation from that source. The cut-off consists of two small slides, connected with each other upon the back of the main valve. The cut-off valve is operated by being connected through a rock arm with the piston of a small auxiliary steam cylinder attached to the bed of the engine, as shown. This cylinder takes steam from the main steam chest and exhausts into the main exhaust pipe. The valve of this cylinder is controlled by the governor, which is located upon an independent shaft driven from the main shaft by means of gears. The eccentric, which operates the valve, is attached to one end of a sleeve, which rotates upon the governor shaft, while a small gear is fixed upon the other end.

Two rack arms—meshing into either side of this gear—are connected with the weighted arms of the governor, so that the gear, sleeve and eccentric are driven by contact of the small gear with the racks, and the racks push or pull at all times in a line tangent to the small gear.

Two spiral springs are attached to the weighted arms, to furnish the required resistance to the centrifugal force of the rotating weights.

To prevent slamming of the cut-off valve in closing, a dash pot or air cylinder is attached to the piston of the small steam cylinder, as shown. When the engine is in operation, the cut-off valve remains wide open until the piston has reached the point of cutting off, when the valve upon the auxiliary steam cylinder opens and the cut-off is instantly closed, thereby effecting a high initial pressure up to the point of cutting off, and a very sharp cut-off.

As an example of the truth of the above assertion, we call attention to the accompanying diagrams, Figs. 1 and 2, on page 2, which were taken from one of these engines. The admission line on both diagrams is continued out very nearly parallel with the atmospheric line, until the point of cut-off is reached. The diagram shown in Fig. 1, page 2, represents a full load, while Fig. 2 was taken every minute, for five consecutive minutes with a shorter cut-off.

These diagrams were selected as a fair average, from a large number, over 140, taken from the engine under every day working conditions. There was a back pressure valve upon the exhaust pipe, which was weighted, for heating the buildings, so as to cause 1½ pounds back pressure upon the engine, otherwise, with a free exhaust, the back pressure shown upon the diagrams, entirely disappears. The clearance in the cylinder to main valve is .023 of its capacity, while that to the cut-off valve is .03. The diagrams here shown were taken with Tabor Indicators, attached to each end of the cylinder. A number of computations have been made from diagrams taken from one of these engines, which show the water consumption to have been 22 pounds to 24 pounds per indicated H. P. per hour.

Where the steam pressure is carried higher, and the cut-off occurs at ¼ or ⅓ of the stroke, the water consumption falls as low as 20.5 pounds per indicated H. P. per hour.

Machinery for Electric Lighting.

Lighting by electricity has already proved to be of great advantage to the machinery industries. Gas works are not good customers for machinery, but steam engines, boilers and dynamo-electric machines are essential to electric illumination. Dynamos are usually built at the shops of the electric-lighting companies, but steam engine builders and boiler makers are experiencing a lively demand for this purpose alone. But electric lighting is, as yet, in its infancy, therefore what may we expect in a few years, when the lighting of streets and public buildings by electricity shall have become a common practice? The number of orders already received by some engine builders to supply motors for dynamo machines is astonishing, but the rapid increase of such orders is even more astonishing to those who have not studied the situation.

The railroads are becoming more strict in regard to extra weight baggage. Orders have been issued on many roads to weigh and check baggage before arrival of trains. Heretofore, a great many trunks, each weighing more than the prescribed free limit, have been carried for passengers without extra charge. Once in a while, railroads that endeavor to be excessively strict with passengers, find themselves outwitted. A case in point happened a few years ago; one party being a well-known actress, and the other party the Newark & New York Railroad. She had occasion to travel from one city to the other, with just sixteen trunks, and upon presenting her ticket to have them checked, was curtly informed that they would not be carried until twenty-five cents each should be paid for the fifteen not covered by her ticket. This heroine of tragedy, comedy and strategy, was not to be checkmated by a few airy railroad officials. She read the ticket carefully, noting that it entitled the holder to the transportation of one hundred pounds of baggage without extra charge. Her next move was to buy fifteen package tickets at the station, paying the regular package price of *fifteen cents each*. Armed with these bits of pasteboard, she confronted the astonished baggage smasher, and compelled him to check each and every trunk, according to the company's agreement printed on the tickets.

The Stove Trade.

The present season has been the most prosperous of any thus far in the stove trade. Foundries that usually shut down from one to three months during the Winter, will run steadily through the season this year, and with an increased force. Several large concerns have been obliged to cancel orders, and others have withdrawn their salesmen. The large run on parlor stoves has kept the foundries at work on them much later than usual, leaving them unable to fill their orders for cooking stoves. Many large firms are increasing their facilities by extensive additions to their buildings, and by adding more machinery.

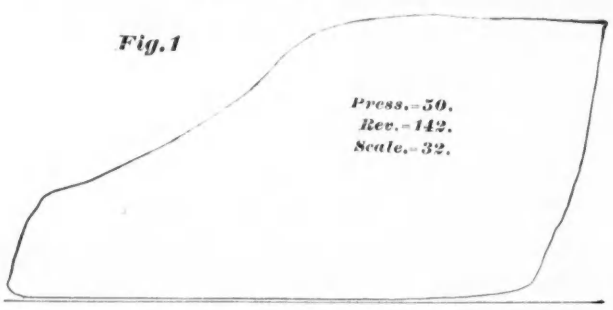
A Southern audience loudly cheered Edward Atkinson when he told them that his second son, at present at Harvard College, was a practical blacksmith and carpenter.

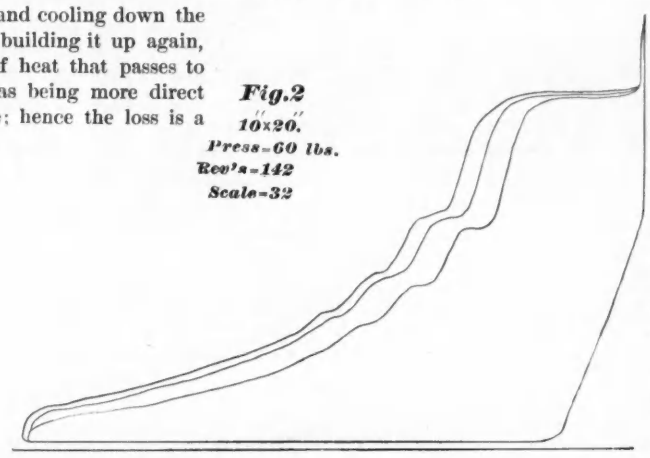
Jones' Fire Jamb Plates and Boiler Setting.

It is probable that no single thing in connection with the use of the return tubular boiler as ordinarily set with flush front, is more troublesome, or causes greater loss than the usual means employed to shut off the connection between the fire box and the uptake or flue at the front end of the boiler. Anything employed for this purpose should effectually prevent the direct passage of the products of combustion from the fire box to the uptake, since it is evident that all heat passing off in this way is practically lost, so far as any useful effect in generating steam is concerned, and not only this, but the heat thus passing off, when considerable in quantity, and, as is usual, of a high temperature, may, by coming in contact with parts of the boiler above the water line, result in material injury to some of these parts.

But this, although a serious defect, is not the only one incident to the prevailing type of boiler setting. An examination of a number of flush front boilers in use for any considerable time, will, probably, in nineteen out of twenty instances, show that the cast iron front is warped and twisted out of all respectable proportions, and, in the majority of instances, is badly cracked and broken. This results not only from the fact that any compound one, consisting directly of the heat thus escaping, and, incidentally, in the damage done by this heat to the front and other exposed parts.

We present, with this, engravings of a new design in boiler setting, the object of which is to prevent the escape of heat in the way referred to, and the damage incident to such escape, as well as the damaging effect of necessitating stopping and cooling down the boiler and setting, and building it up again, causes a constant loss of heat that passes to the flue in this way, as being more direct than the proper course; hence the loss is a





CARDS FROM AUTOMATIC ENGINE.—See page 1.

compound one, consisting directly of the heat thus escaping, and, incidentally, in the damage done by this heat to the front and other exposed parts.

We present, with this, engravings of a new design in boiler setting, the object of which is to prevent the escape of heat in the way referred to, and the damage incident to such escape, as well as the damaging effect of tuted, in like manner, for the brick work, or other shields.

Of course, if these plates were not in turn protected from the heat of the furnace, they would be quickly destroyed; and for this purpose they are cast hollow, and a constant circulation of air through them prevents their being heated sufficiently to injure them. For the purpose of utilizing the hot air, after

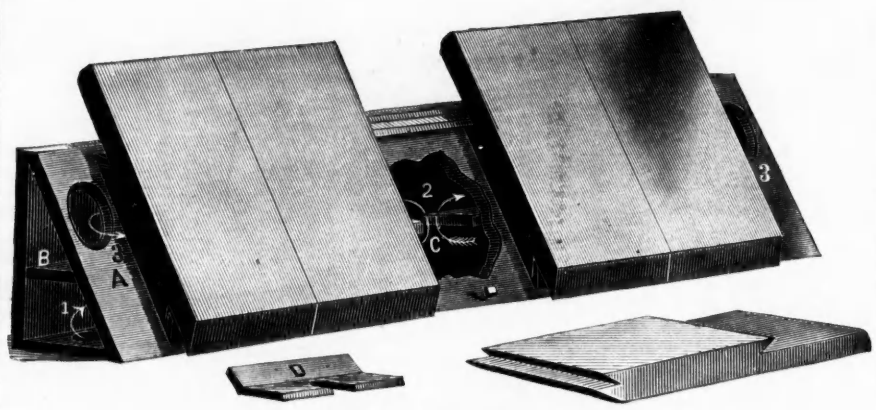


FIG. 1.—ARCH PLATE.

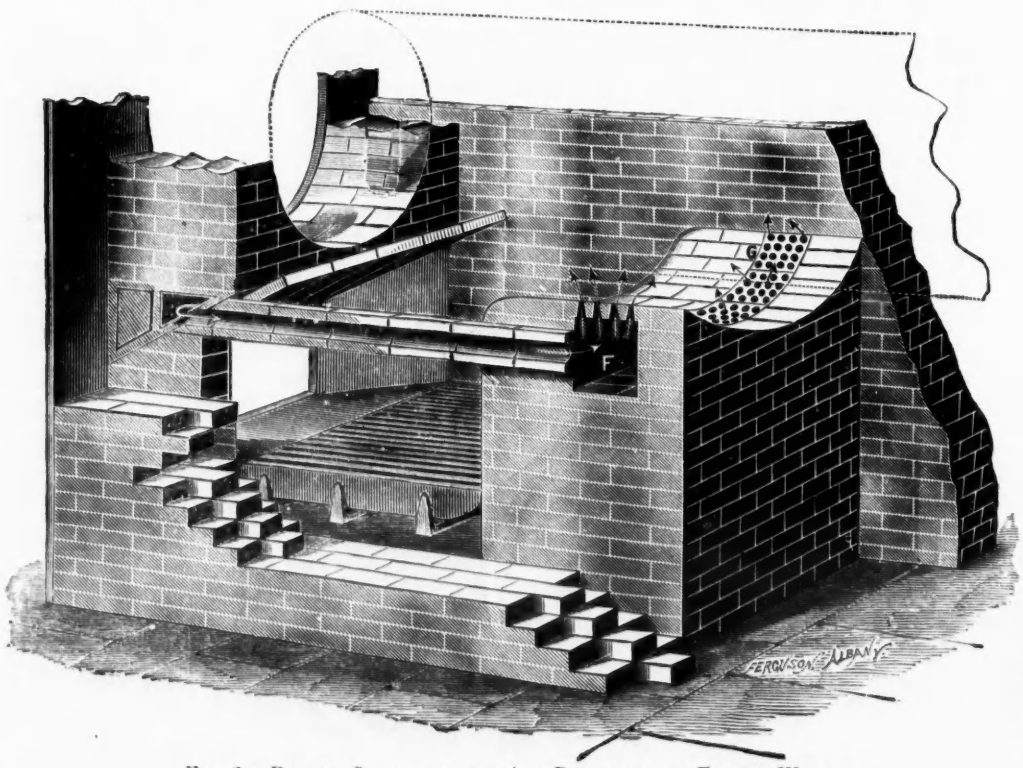


FIG. 3.—BOILER SETTING, WITH AIR DELIVERD AT BRIDGE WELL.

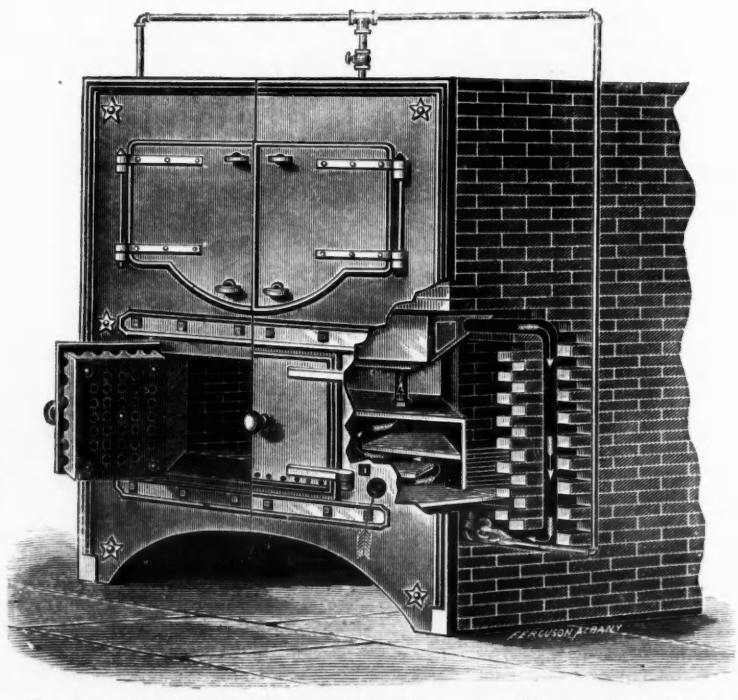


FIG. 2.—BOILER SETTING, WITH AIR DELIVERED UNDER GRATE BAR.

brick setting over the fire door and the corners at the sides, which serves to protect the front, as well as to act as a shut-off between the fire box and uptake, will not, under the intense heat to which it is exposed, maintain its integrity for any length of time, but also that these brick, notwithstanding their poor conductility, will, when subject to intense and constant heat, finally themselves heat the front to an injurious extent, while iron used as a shield, either as an entire mouthpiece or as side guards, is so quickly destroyed as to hardly be worth consideration.

It follows that the gradual displacement of the fire-brick setting, which usually begins with the first fire put in the furnace, and continues until the arch gives away entirely, highly-heated masses in contact with the boiler front, and at the same time bring about an actual economy in the consumption of fuel. Of these Fig. 1 is a perspective view of an arch plate, which in its use supersedes the ordinary brick arch over the fire doors of the furnace. This plate, which is hollow, is of cast iron, the face being lined with iron stone, secured in a manner clearly set forth by the engraving.

Fig. 2 represents the arch plate in position, and also the jamb plates, and clearly shows the manner in which they are used in connection with an ordinary boiler front and brick setting. It will be seen that the arch plate, as stated, takes the place of the usual fire-brick arch, while at the sides of the door the hollow cast-iron jamb plates are substi- it has passed three times through the side plates and twice through the arch plates, it passes through a flue in the brick work and down under the grates. To insure a positive circulation at all times through these plates, a small steam jet is connected with this flue, which may be used when the damper is closed, or at other times if found, as is frequently the case, that a small jet under the grate is advantageous. The course of the air through these plates and flues is plainly pointed out by the direction of the arrows.

Fig. 3 illustrates the construction and arrangement of the parts when it is thought advisable to use the air, previously heated at the front, at the bridge wall, as is frequently done, it is claimed, with good economy in the use of ordinary fuel, and which is of undoubted advantage in the use of some kinds of fuel. It will be seen that, instead of passing the air down and under the grate, as previously described, it is conducted directly back to the bridge wall, which is made hollow for the purpose, and provided with suitable perforations through which it passes, and is brought in contact with the over-passing unconsumed gases, bringing about their combustion, and resulting in saving heat that would otherwise be wasted.

It will be seen that the improvements consist chiefly in the addition of the appliances described to the ordinary boiler setting; these appliances, it is claimed, lasting as long as the boiler itself, with the exception of the iron stone lining, which it is conceded may require to be renewed after a time, although a year of constant use has in no way affected them. When, however, any repairs are necessary, it will be seen that the plates being entirely independent of the fire walls, it is the work of but a few minutes.

These fire-jamb plates, and all appliances necessary for setting boilers on this plan, are made by the Cohoes Iron Foundry and Machine Co., Cohoes, N. Y.

New Compressed Air Locomotive.

During the past few weeks a new locomotive, driven by compressed air, has been making frequent and successful trial trips upon the Second Avenue Elevated Railroad, in this city. This locomotive, of which we present an engraving, made from a photograph, was recently built at the Baldwin Locomotive Works. It is the invention of Robert Hardie, of Edinburgh, Scotland, who has been experimenting upon compressed air motors in this country for several years past. Heretofore his experiments have been confined to motors upon the surface road now operated by horse cars on Second Avenue. One of these motors was illustrated with a detailed description in the AMERICAN MACHINIST of October 18, 1879. They ran successfully on the road alluded to, and proved their superiority and economy to horse cars both in cost and running expenses; but for reasons which are not clear to us they have not yet been adopted.

The locomotive here illustrated has four driving wheels 42″ in diameter, with a two-wheeled swinging truck. The cylinders are 12½″×18″, and to the casual observer the running gear presents about the same appearance as the other locomotives upon the elevated railroad. Instead of the usual boiler, however, there are four large air reservoirs, three feet in diameter, the lower one extending the entire length of the engine frame. The other three extend only about two feet inside the cab to allow space for engineer and fireman, as well as pipes and other appliances.

These reservoirs are all connected, and the pressure is drawn equally from each.

A single reservoir, made of an equal quantity of the same material as the four reservoirs, would answer the purpose of holding the air, but would, on account of its large diameter, have to be placed much higher, which would necessarily obstruct the view of the engineer and raise the center of gravity.

With the present arrangement the center of gravity is about the center line of the lower reservoir, and the engineer's view of the track is uninterrupted.

The capacity of these four reservoirs is 460 cubic feet. They are made of Otis steel, ½″ thick, weighing 23 lbs. to the square foot, and having a tensile strength of 75,000 lbs. per square inch of section, and are riveted with ⅞″ iron rivets placed 3½″ from center to center. There are no straight longitudinal seams, but the sheets have been cut so as to give the seams a spiral course about the reservoirs. These seams are secured by three rows of rivets, while the circular seams have two rows of rivets. By this arrangement it is calculated that these reservoirs are fully as strong as if they were made in seamless solid sheets.

All the seams are caulked by concave caulking tools, which insures very fine appearing seams, and absolute freedom from leaks without weakening the material. These reservoirs have been tested to 800 pounds pressure per square inch. The air is compressed into the four reservoirs up to a pressure of 600 pounds per square inch.

For the experiments now in progress the same plant is used as was previously described in the AMERICAN MACHINIST, and used for the street car motors, with the exception that the compressor pumps directly into the reservoirs upon the locomotive, through a pipe. The engine which drives the compressor is rated at 100 H. P., and fills the reservoirs upon the locomotive at a pressure of 600 pounds in one hour. Should this style of locomotive be adopted on the elevated railroad, a larger plant could be made to fill the reservoir in a very few minutes.

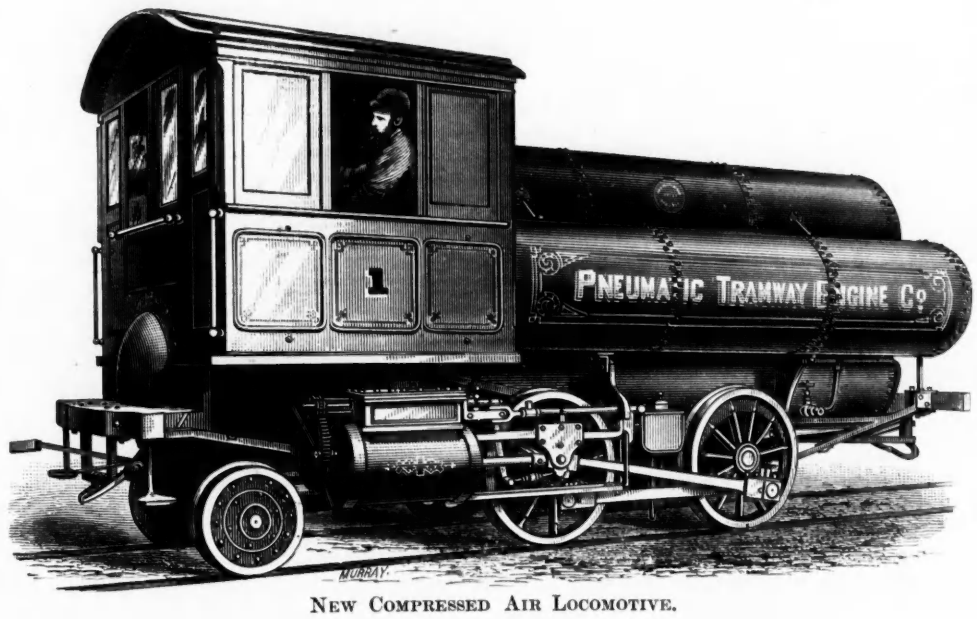
The air, upon leaving the reservoirs, passes through the boiling water in an upright tubular steam boiler, placed upon the top of the lower reservoir within the cab. This boiler is 32″ in diameter and 60″ high, and is intended to heat the air to about 240 degrees temperature Fahrenheit, that having been found to be the best in practice. The air thus heated, in bubbling up through the water takes up considerable moisture, so that in addition to getting the benefit of the expanded air the cylinders are also as well lubricated as when steam is used. Cylinder oil is also used to insure perfect lubrication of the valves and cylinders. The air passes through a reducing valve, by which the pressure, as it enters the steam chest, is reduced to 120 pounds to 130 pounds per square inch. A safety valve is placed upon the pipe near the upright boiler, to prevent an excessive pressure. The valve motion is an interesting feature of this locomotive. It consists of a slide valve with a constant travel of 2″. The reverse lever is provided with but three notches, so that it must be either full gear ahead or back, or at mid gear. The cut-off is effected by two slide valves placed upon the back of the main valve, and adjusted to and from each other by means of a right and left hand screw upon the valve stem. For adjusting the cut-off a pinion is splined upon the valve stem at the front end, and is rotated by a toothed sector, as shown in the engraving. The toothed sectors are in turn operated by suitable connections, with a right and left hand screw upon a transverse shaft within the cab. By turning a hand wheel upon this shaft, any desired cut-off may be attained. Only four eccentrics are used to work the main valves, the cut-off valve stems being connected with the cross heads, and are operated by lever and pitman, as shown, and have a constant travel of 3½″. In running down hill and in coming to a stop at stations, by a very ingenious arrangement and reversing the lever, the cylinders are made to act as air pumps to force air into two small storage reservoirs placed for that purpose, between the upper and lower reservoirs. By this arrangement, the air which constitutes the power in the reservoirs, is reinforced and acts like a huge spring in starting the train from the station.

A check valve is placed within the exhaust pipe to prevent any air from entering the cylinders from that source.

By closing an air valve connected with the saddle of the cylinders and reversing the lever, the cylinders pump the air from the pipes and chambers under the cars, thus producing a vacuum and applying the brakes. This operation is so mild that no sudden shock is given to the train, yet the efficiency of the brake is neither retarded nor impaired.

In reversing this engine there is no danger of sucking sparks and dirt through the exhaust pipes into the cylinders, destroying their surfaces and the valve seats.

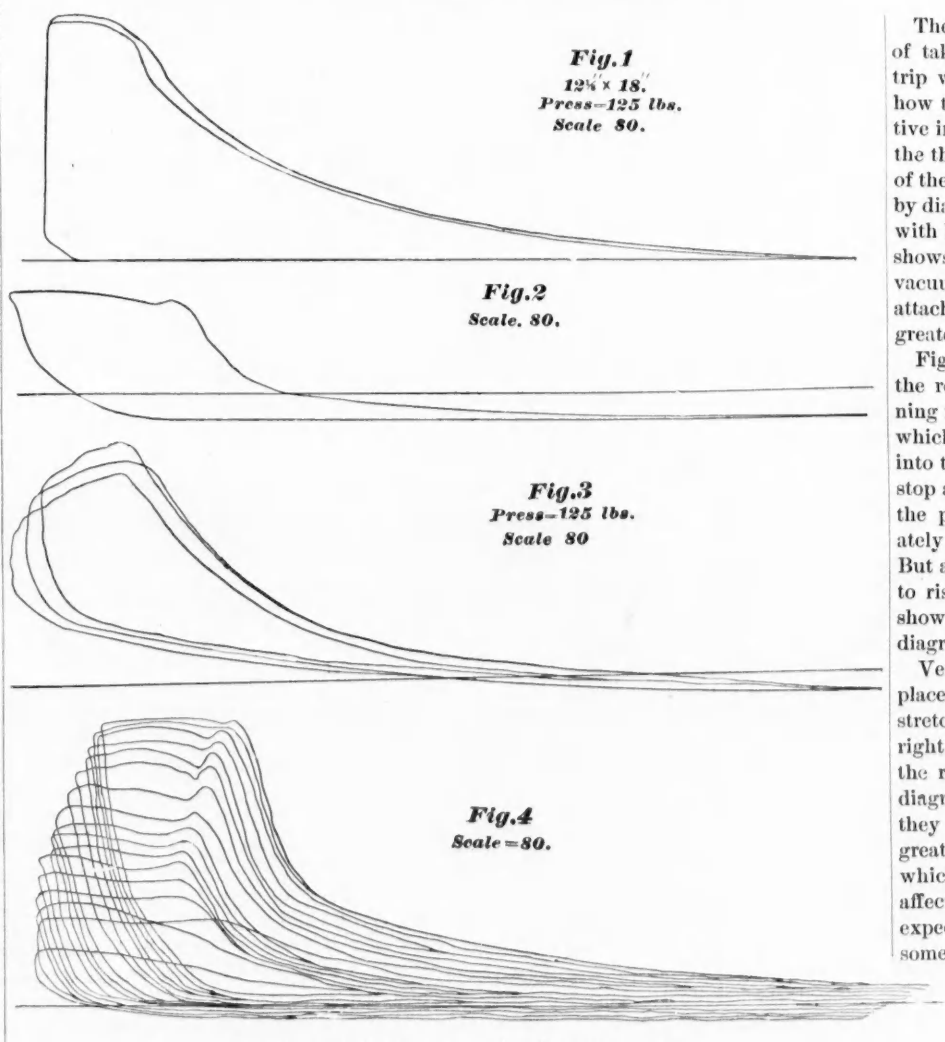
The engine here described, recently drew a regular train of three cars, with passengers, from Harlem to the Battery, a distance of 9 miles, in 37½ minutes, the schedule time being 40 minutes—making all the stops. The air pressure in the reservoirs at starting was 600 pounds, while in making the trip to the battery it was reduced to 155 pounds. With this reserve pressure the locomotive ran light as far as Forty-second Street, where it was placed upon a side track, with still 50 pounds pressure in the reservoir. This locomotive will run light, with a pressure of 25 pounds, and will haul a train with 50 pounds pressure. It is the intention to have a plant for compressing air, both at Harlem and at the Battery, should the engines be adopted on the elevated road. This locomotive can be charged to run ten miles, or will require to be refilled every three-fourths of an hour. We are informed that certain parties building air compressors offer to put down a plant which will charge an engine with air every three minutes should it be required. The engineer, John Wallace, who runs this locomotive, says: "I like the engine very much. There is no coal, no feed water to look out for, no trouble in making steam, with bad coal and a dirty boiler, no danger of burning the boiler, no leaks, no danger from an explosion, no boiler to wash out, no cinders and ashes to fly into the cars, streets and houses, and the poisonous coal gas is, by the use of this principle, entirely avoided." A locomotive will stand all night with 100 pounds pressure, and may be moved at a moment's notice without aid from any other source of power outside itself; or, if an empty engine was to be moved, a supply of air could be readily supplied from another locomotive. Should an extra engine be required for the road, from five to ten minutes notice would be all the time necessary, instead of waiting several hours to build a fire, raise steam, and get a supply of coal and water. In a few days, we understand, an official trial of this engine is to be made to demonstrate its true economy, and should the trial prove as favorable as those already made, there will probably be more of these engines built and put upon the elevated railroad.



NEW COMPRESSED AIR LOCOMOTIVE.

When the road is equipped with pneumatic locomotives the numerous and general complaints of inhabitants along the line in reference to damage done by cinders, dirt, dripping of water upon passers by, noise from escaping steam, filling residences with poisonous coal gas mixed with steam, and many other nuisances connected with the use of steam, will entirely disappear.

The locomotive here illustrated weighs a trifle over twenty tons, and it has already been demonstrated that a number of changes can be made to advantage which will increase the economy in working the engine. Such changes as are found necessary will be made upon the locomotives built in future. In addition to the engraving of the locomotive, we also present a number of indicator diagrams taken from this engine without any cars attached.



CARDS FROM COMPRESSED AIR LOCOMOTIVE.

The opportunity will be given very soon of taking some diagrams during a regular trip with a train. Diagram Fig. 1 shows how the air may be expanded in a locomotive in starting rapidly from a station with the throttle wide open. There is an absence of the usual excessive compression, as shown by diagrams taken from a steam locomotive with link motion cutting off short. Fig. 2 shows the vacuum produced in applying the vacuum brake to the locomotive only; when attached to a train the vacuum produced is greater.

Fig. 3 shows a peculiar effect of placing the reversing lever at mid gear, while running fast. Fig. 4 represents the manner in which the air pressure increases by pumping into the two small reservoirs in coming to a stop at a station. When the throttle closes the pressure within, the cylinder immediately falls and a slight vacuum is produced. But as soon as the air is admitted it begins to rise with each stroke of the piston, as shown by Fig. 4, which forms a series of diagrams taken consecutively.

Very fortunately a new cord had been placed upon the indicator, so that by its stretching each card is carried further to the right and occupies a distinct position from the rest. If the cord had not stretched the diagrams would have been so mixed that they could have been made out only with great difficulty. The height of the diagrams which indicates the pressure is not at all affected by the stretching of the cord. We expect next week to present engravings of some of the most important details of the pneumatic locomotive, with descriptions of the same.

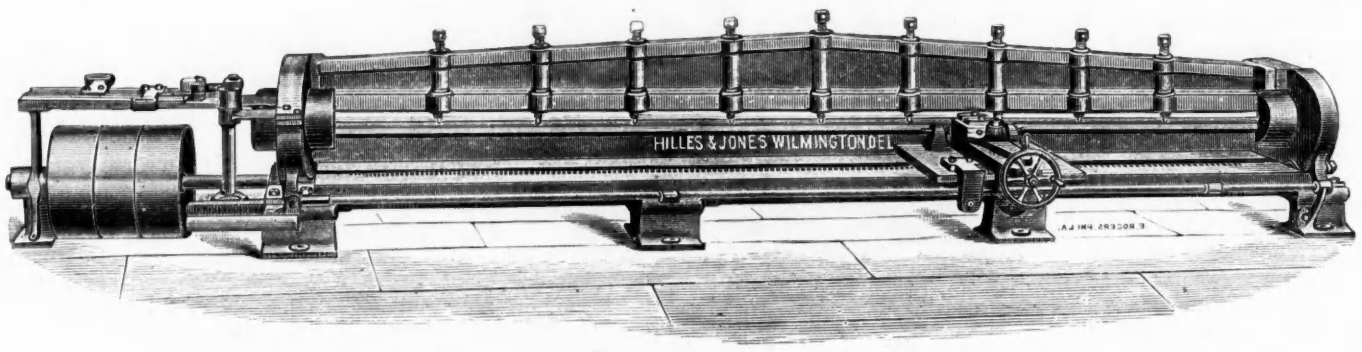
At the opening of a branch of the South London Free Library and Art Gallery, recently, Professor Rogers, M. P., expressed regret that the artisans of London were so poorly provided with literary conveniences, and told his audience that in America things in this respect were managed much better, and, as a consequence, that an uneducated American of the second generation was hardly ever met with. He said that American artisans were all great readers, and were able to discuss fairly any topic raised, and paid a high tribute to their polite behavior at political and other meetings, contrasting the behavior of the same classes in England, in a manner unfavorable to the latter.

New Plate Planer and New Plate Bending Rolls.

We illustrate with this two new tools used in ship building, boiler making, and in various plate metal working industries, and which seem well designed to serve the purposes of such machines.

The first is a plate planer, designed for rapidly planing and beveling the edges of plates of any size, planing a length of 13 feet, 10 inches at one setting, when by resetting the length may be extended indefinitely.

The table which holds the plate, while serving this purpose, also answers as a gauge for quickly setting the edge, thus doing away with any necessity for using a rule, or in fact, any other device whatever for this purpose. The plate is placed on this table, between the surface and the cross bridge, being firmly held in position by the latter.



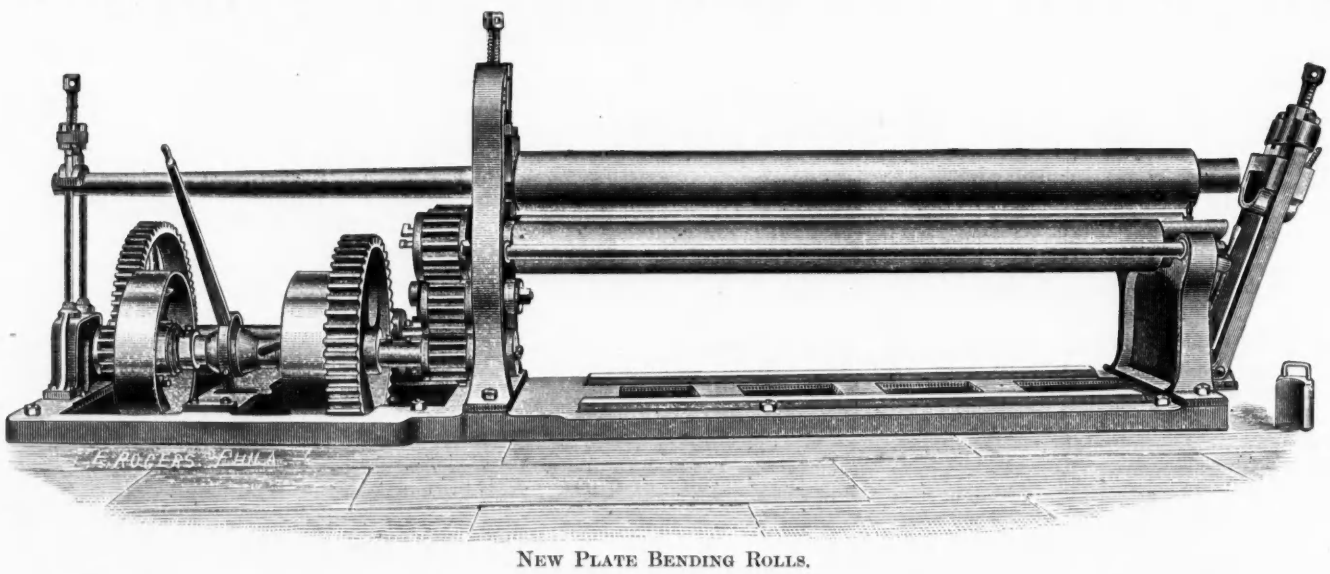
NEW PLATE PLANER.

The nine screws shown in the cross bridge are primarily for straightening and taking the buckles out of the edge of the plate to be planed, but they incidentally serve the purpose of assisting in holding the plate to the table.

In using this machine a cut is taken while the head is traveling both ways, for which purpose two tools are provided, which are so arranged that either may be independently adjusted, and when properly adjusted, both are under control of the hand wheel, which, in its operation, feeds the two tools simultaneously.

The head or saddle is moved forward and backward by means of a large steel screw, supported its entire length in a suitably arranged groove, that effectually prevents it from injury and provides for its being properly lubricated.

It is said this machine will easily do the work of twelve expert boiler makers, and, as is well known, work done with a machine of this character presents a true edge, correctly beveled for caulking, and is more satisfactory than when done with a chisel, by which the adjoining sheet is usually more or less scored and frequently seriously injured.



NEW PLATE BENDING ROLLS.

The second engraving represents a set of plate bending rolls, designed to be driven by a belt, being strongly geared as shown, and provided with friction pulleys for stopping and starting instantly. The extension of the top roll to the left, where it passes under the padded set screw, in connection with the hinged housing at the right, illustrates the readiness with which the top roll can be balanced for removing the section after it has been rolled to a complete circle. These rolls are made of solid wrought iron, the extension of the top roll, previously mentioned, being forged solid with it. The boxes are well proportioned for size and length, and the stands are strong and well braced, rendering derangement improbable. They are furnished of any size or length desired.

These two machines are made by Hilles & Jones, Wilmington, Del., who inform us that, although they are of recent origin, their efficiency is such that some of the leading shops of the country have put them in and that new orders are being constantly received.

The Atlanta Cotton Exposition.

MOTIVE POWER IN THE MAIN BUILDING—COTTON IMPROVEMENT AND THE FERTILIZER INDUSTRY—AGRICULTURAL IMPLEMENTS IN THE SOUTH—COTTON GINS AND COTTON MACHINERY.

Atlanta, Ga., Nov. 17, 1881.

Editor American Machinist:

Sonny, *when you come this way* bring my linen coat," was the suggestive message which the old curmudgeon rapped out to the young scapegrace at the seance. The sunny south rarely makes its appearance, and those who did not bring their water-proof coats are sending home for them, or using the ordinary expedients of money, brass, or good looks, to obtain them in this city. As it rains on little provocation here at this season, and then clears off, it is wise to be provided with waterproof coats.

Special trains running frequently, transport visitors to the Exposition grounds. The cars are provided with seats especially arranged to facilitate the needs of a large number of passengers.

Passing through the turnstiles at the entrance of the park, the first impressions are of a most pleasing nature. Extending for hundreds of yards in either direction, the undulating grounds are tastefully laid out with walks among lawns, diversified with parterres of flowers and foliage plants; the numerous buildings decorated with the flags of all nations, present a scene, whose brilliancy invokes pleasant reminiscences of the Centennial of 1876.

The main building is in the form of a Greek cross, and represents, in a general way, the features of the excellent form of mill, designed by Mr. W. H. H. Whiting. It is one story in height, with flat roof, lighted by monitors. It is in every way fitted for the needs of the fair. The architects are Messrs. Fay & Eichberg, of Atlanta.

The machinery in the east wing is driven by a Harris-Corliss engine, cylinder 14 by 48, running 75 revolutions. This wing contains cotton pickers, sewing cotton, the Clement attachment, the silk industry, wire fencing machinery, fire apparatus, and mill supplies.

The north wing is operated by a Porter-Allen engine, cylinder 11½ by 20, running 220 revolutions, and is devoted to cotton thread, raw and manufactured cotton, and woolen machinery.

The south wing is filled with machinery for cleaning, ginning and packing cotton, all of which is in operation and driven by a C. H. Brown engine, with cylinders 15 by 38, and running at 75 revolutions.

The west wing is filled with cotton-thread machinery and sewing machines, all driven by a Colt disc engine. There are also portable engines in operation, pumps, steam fittings, and farmers' supplies, other than seeds and agricultural implements.

The steam is furnished by two compound tubular boilers, built by Sullivan, of Central Falls, R. I., and rated at 100 H. P. each. Also two Babcock & Wilcox boilers, of 125 H. P. each, which are provided with furnaces especially designed for bituminous coal mined in the south. The front grates incline at an angle of about 35 degrees. Above these grates is a reverberatory arch; as the coal becomes coked, it is fed down the inclined grates to the grates of the furnace proper. This exhibit is under the charge of W. H. Odell, M. E., of New York, who is to conduct tests of the steam generators.

The other buildings will be referred to as their exhibits are considered in detail.

From time immemorial the fiber of the cotton plant has been spun and woven by processes which have not radically changed in their sequences with each other, or in their results upon the manipulation of the staple. It is said that the Sanscrit word for wife, among our Aryan ancestors in India, merely signified weaver. The fact that cotton lint is a flat fiber, with twists or convolutions which fit into each other when pressed together, is common information upon the subject.

The effect of spinning is really a lateral compression condensing the fibers together to the density of hard wood.

The pertinacity with which the fibers of cotton retain their twisted form is so great that in cotton rags which have been worn, exposed to every injury of rough usage, boiled in chemicals, macerated in water, ground and made into paper, these convolutions still retain their form.

In short, as long as cotton staple retains the fibrous form, it is a twisted fiber.

Notwithstanding that cotton has been used from the earliest antiquity by every race outside the frigid zone, the cultivation of cotton has been carried to an extent scarcely beyond the domestic use of a plant. Its improvement never received scarcely any attention until late years, and its susceptibility to improvement, in yield and staple, is shown by the numerous instances where the yield of lint has increased sixfold under good cultivation and careful selection of the choicest seed. This increased production has been accompanied with an improvement in the staple.

The desired increase of the cotton crop must arise from thorough cultivation with the best varieties, and not from increased acreage. This is the only means by which King Cotton can retain his throne among the products of American soil.

In the Exposition the fertilizers are shown by sixteen companies and firms from South Carolina, who exhibit fertilizers made from the phosphate of lime deposits existing in detached masses, which are dredged from certain rivers near Charleston and Beaufort, S. C. They are also excavated from beds in the surrounding country These nodules are washed and ground, then treated with sulphuric acid to release the phosphoric acid from combination with the lime. Potash and ammonia, in the form of slaughter-house refuse, is added to the mixture.

Some farmers buy the acid phosphate, and supply the potash and ammonia by addition of ashes and stable manure.

The extent of this industry may be understood by the statement, on the authority of E. Willis, of Charleston, that 266,734 tons crude phosphates were shipped during the year ending May 31, 1881. Prof. Chas. U. Shepard, Jr., M. D., Chemist to State Department of Agriculture, estimates the area of the readily-accessible deposits of phosphates at 10,000 acres.

The dredging, washing and grinding these phosphates require elaborate mechanical appliances.

The subsequent treatment of the phosphate, to produce a fertilizer suitable to the needs of various soils and crops, demands the highest chemical skill. In this rapidly growing industry there must be a wide field for the engineer and the chemist. There are also large exhibits of the well-known fertilizers made from slaughter-house refuse, bones and guano.

The agricultural implements are contained in a large annex, covering three-fourths of an acre. Here are said to be all the standard implements used in the cultivation of Southern soil, and, with the exception of one cultivator from Troy, Ala., I could not find anything which was made in the South.

On inquiry at an exhibit of plows from Atlanta, I was informed that the iron work was made in Pittsburgh, Pa.

The cultivator from Alabama was the only one ever built, therefore this solitary representative of Southern industry was made, and not manufactured by organized work, as is necessary to produce such articles with financial success.

The mountains here are rich with mineral ore, and her soil abounds in timber, yet

the only Southern plow in the whole exhibition is wholly of wood, being hewn from the crotch of a tree, and until taken for the exhibit of the Cincinnati Southern Railway, was in use in the mountains of Tennessee.

As a growing agricultural country, it seems as if the South presents a field for the successful manufacture of farmers' implements.

The experimental plots of land in the park are of more interest to the agriculturist than the mechanical reader of the AMERICAN MACHINIST, therefore we will resume the mechanical treatment of cotton.

The cleanliness of cotton is a great factor in its classification, and cotton cleaners are shown which remove the dirt from cotton as it comes from the field. It is then easier to remove dirt than later, when it has been pressed into the fiber. It is justly claimed that the use of a seed-cotton cleaner increases the value of cotton so much, that it is one of the most profitable operations in its treatment.

Mr. Edward Atkinson, the eminent cotton authority, in an address made the following statement respecting the importance of skill in the preliminary operations upon cotton:

> There is no great staple of the world so wastefully handled and prepared for market as cotton, unless it is sugar.
>
> If cotton were properly handled in the gin house, and properly picked and carried to the gin, all of it that is now ginned below middling would command from two to five per cent. more, because it would be rid of the mote, leaf and dust that level it to a low grade. But more important than this, I venture the assertion that cotton—the greater part of the crop, anyhow—is deteriorated in value fully ten per cent. from the time it is picked in the field to the time when it is turned out from the compress for shipment North. A very important and costly part of the work in the Northern factories is remedying the errors of picking, ginning and packing—that is, removing the dirt, sand and grit that has unnecessarily been allowed to get in with the fiber. Beyond the cost of this work, the fiber itself suffers from the excessive handling necessary to clean it of dirt that should never have been allowed to get in it. The machinery in mills suffers, too, because of the failure to clean the cotton, before it is compressed into bales, of the almost impalpable sand or dust that infests the cotton grown on many soils. Not only can the cotton be cleaned more efficiently before it is packed than afterwards, but with one-third the labor, not to consider that a proper handling of it would keep out the greatest part of the dirt that is found in it when it reaches the mill.

Various types of cotton gins are shown. In the exhibit of the Willimantic Linen Company, there is shown a small gin which is claimed to have been the model made by Eli Whitney, in 1798.

I do not wish to antagonize the claim that it was made by Whitney, but it does not agree in minor points with the description of the original one made by him; and as a matter of memory, I am quite sure the United States Patent Office model was burned in 1815. At all events, Whitney invented the first saw gin, and this model is an interesting relic of important beginnings.

The earliest cotton gins were made in India, and from the crude use of a round stick upon a flat stone, was developed the chourka, which consisted of two rollers of different size, which twisted the fiber from the seed.

The saw gins are universally used in this country, and are exhibited with the various improvements for feeding, delivery, and freedom from clogging, but all retain the gang of circular saws invented by Whitney.

The saw gin removes the seeds very rapidly, but cuts the cotton fibers barbarously, and the damage is increased whenever the saws are not in good order, or the seed cotton is clogged over the saws.

In India it is necessary to use either the roller or knife-roller gins, which are forms of the chourka, built according to modern methods of construction.

The Government of British India made extensive experiments, with a large number of gins, upon the various kinds of India and Egyptian cotton, and also some kinds of American cotton. The work was performed on a large scale; the cotton was spun and inspected betweeen every operation.

Two large volumes contain the results, which showed that the saw gins performed their work more rapidly, but the knife-roller gin delivered it in better condition, so that there was much less waste, and the yarn was stronger.

There is one English knife-roller gin on exhibition, and another one has been delayed in shipment, but is expected.

There is also a modified form of the knife-roller gin made in this country, for Sea Island, long-staple cotton.

There is an opportunity for inventors to make a roller gin fitted to the needs of American cotton. It must not injure the staple, crush or tear the seed. It must be rapid in its operation, simple in construction, and free from delicate adjustments, so that it can be used by unskilled, and even ignorant labor.

From the cotton gin the product is in two forms, the seed and the lint.

The waste and utilization of the cotton seed will be taken up later, and we will now consider the use of the lint. The various methods of packing, pressing and fastening bales of cotton, is shown.

Much interest is shown in the Dederick system of packing, where cotton, fed from a huge bin, is compressed in small bales, weighing 45 pounds to the cubic foot, or the heaviness of elm wood. These bales are automatically fed out, bound with wire and covered with burlap. The bales contain $2\frac{3}{4}$ cubic feet, and weigh 125 pounds.

C. J. H. WOODBURY.

New Locomotive Steam Crane.

The use of steam cranes for hoisting and moving heavy weights, and adapted to propel themselves, either on a permanent or temporary track or tramway, while not so general in this country as in some European countries, is, as their convenience is better understood, becoming more common. By their assistance iron, stone, or other heavy material is almost instantly picked up, moved from one position to another, loaded on cars or other vehicles, or by means of the ability of the machine to propel itself, moved to considerable distances when required.

Our engraving represents a machine of this character, which is believed to be a convenient and well constructed one of its class. As will be seen, it consists of a strong, rectangular iron truck frame or body, mounted on wheels and adapted to sustain the machinery proper of the crane, which is attached to a revolving base.

The motive power consists of a pair of inclined direct-acting link motion engines, connected at right angles to a single crank shaft, from which the power for hoisting, revolving, altering the radius of the jib and moving forward or backward, is taken.

The hoisting drum is connected to the crank shaft by spur gearing, and the load may be lowered by reversing the engines, or by friction brake, the arrangements for this latter purpose being such that the gearing can be instantly disconnected and a powerful brake applied to the drum, which will hold the weight suspended, or allow it to be lowered by its gravity.

In revolving the crane, a double cone friction clutch is brought into play, by the means of which it can be revolved in either direction without reference to the motion of the engine, making it unnecessary to reverse the engine, and allowing the crane to be swung either way while hoisting, lowering or propelling.

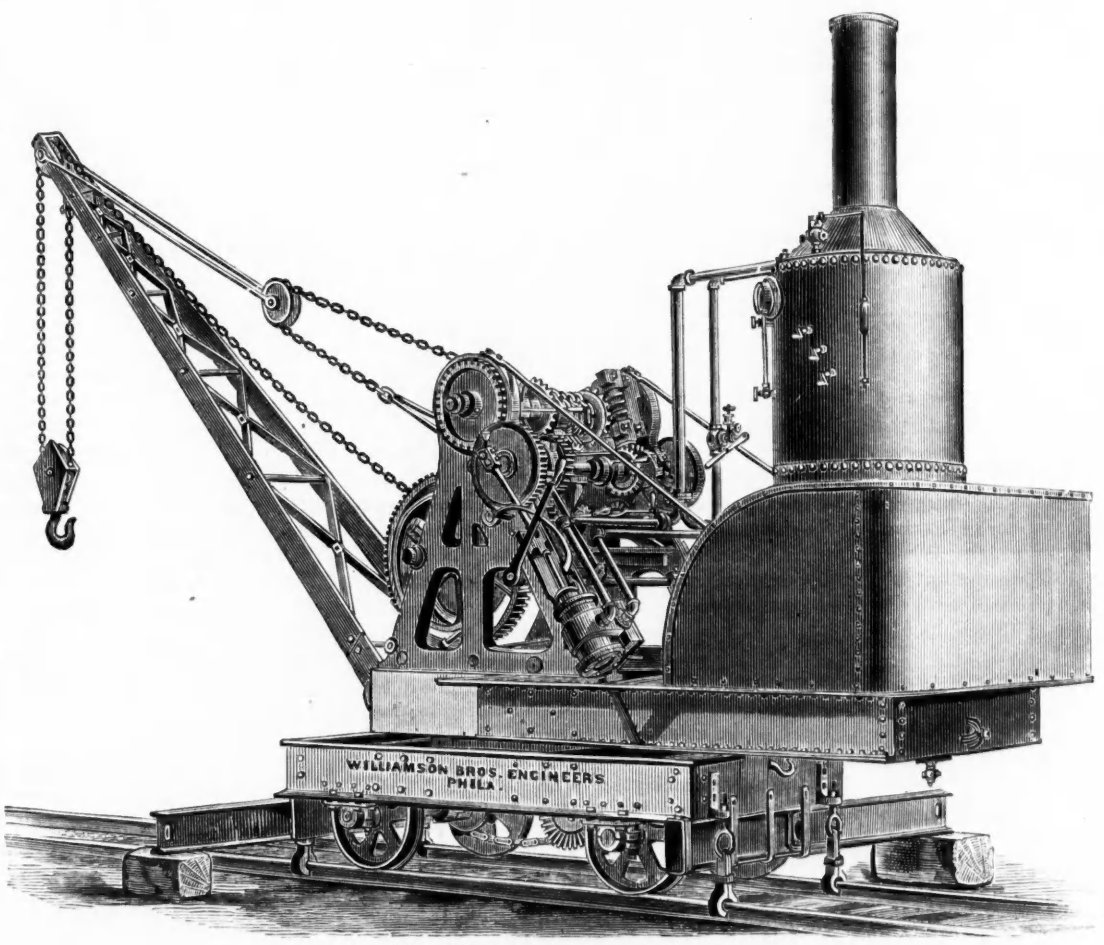
The radius of the jib is changed by means of the chain shown as passing over the chain pulley; one end of this chain being attached by the connecting link to the frame, while the other is attached to, and wound around, the drum at the top of the housing. This drum receives its motion from worm gearing, which positively locks the jib in any desired position.

The traveling motion is transmitted by bevel gearing to a shaft below the truck frame, where the connection is made with the axle by means of chain wheels and an endless chain.

The revolving base is provided with a water tank situated under the boiler, from which water is fed by an injector, and at the sides and back with a substantial iron coal bunker, in which ballast may also be placed as a counterbalance, if thought advisable.

Rail-clamps are attached to the truck frame, and for narrow gauge, cross girders, to give additional base for heavy work.

The crane post is of steel, the wearing surfaces appear to be ample, and altogether the machine presents the appearance of being well designed for strength and durability.



NEW LOCOMOTIVE STEAM CRANE.

These Locomotive Steam Cranes are built by Williamson Bros., Engineers, Richmond and York Streets, Philadalphia, Pa.

LETTERS FROM PRACTICAL MEN.

Voyages at Sea—Getting Under Way.

Editor American Machinist:

The first thing to do is to see that there is sufficient water in the boilers; blow cocks shut, man-hole plates on and screwed tight; then start fires, leaving the safety valve and the throttle valve open to let the hot air pass out of the first, and a part passing into the cylinder to warm it up. As soon as steam begins to form, close the safety valve. The steam that goes into the cylinder to warm it up must be blown out through the waste water cock; for, if it is allowed to pass into the condenser, it will destroy the vacuum. When steam is up, put the starting bar into the trip shaft; and, if there is an independent circulating pump, see that it is started, so that we may have a current of water passing through the condenser, for it will get hot, and the steam will not be condensed if no water is passing through it. But, if the circulating pump is worked by the main engine, fill the condenser with cold water by opening the injection valves. See that the delivery valves are open, and give a little steam, moving the piston up and down, but taking care not to make a revolution until you know everything is clear; then give steam and hook on. By hooking on we mean to drop the hooks on the eccentric rod into the arms of the rock shaft; that works the steam and exhaust valves. The exhaust steam passes into the surface condenser; and, since we are fairly under way, I will try and explain the work of the surface condenser. It is made in two water-tight compartments. The injection water passes through the tubes with which the condenser is filled (called the salt water compartment); thence overboard through the outboard delivery. The exhaust steam comes in at the top, strikes the tubes filled with cold water, is condensed and falls to the bottom. It is then taken by the air pump and carried into the hot well, and from thence it is taken by the feed pump and returned to the boilers. The temperature of the hot well is about 100°. The object of using the surface condenser is to keep the exhaust steam and injection water separate, and in so doing we get fresh and hotter water for the boilers. With a jet condenser the exhaust and injection water is mixed, giving colder and salter water for the boilers. The jet condenser is not used on modern engines. The surface condenser is much more economical and better in many ways. But the condenser does not wholly supply the boilers, for a portion of it is wasted by leakage, blowing off steam, opening blow-off cocks, gauge cocks, etc. The deficiency, however, is obviated by means of a pipe and valve, which leads from the salt water side of the condenser, or from the injection, into the fresh-water side. This is called the salt feed, salt water being admitted when necessary. As soon as we commence using the salt feed we commence salting up our boilers. This, then, must be watched and attended to, for the water in the boilers will soon become so dense that we cannot keep up steam. The density of the water in marine boilers is usually from $1\frac{3}{8}$ to 2, and is determined by an instrument called the saline hydrometer—an important instrument often used at sea. Sea water contains 3.03 parts of its weight in saline matter, but the saline hydrometers are graduated to three parts of saline matter in 100, or one in 33, as it is preferable to use the whole number three, instead of the mixed number

3.03. This instrument is also graded to 180°, 190° and 200° for temperature, and is used by placing it in water drawn from the boilers, the bucket or cup holding it being deep enough to float upright without touching the bottom. As soon as the cup is filled, place the hydrometer and a thermometer in the water, and, when it has cooled to the temperature at which the hydrometer is graduated, note the point at which the surface of water comes in contact with our hydrometer, and that will give us the density of the water in the boilers. To freshen the water in the boilers, we will have to blow off a portion of it through the surface blow valve, which ought to be opened every two hours, or twice a watch. But every time we open the blow-off cock we lose a certain percentage of heat; and in this case, if we maintain a density of $\frac{2}{32}$ in the boilers, and blow off at that point, the proportion of heat lost will be 7.9, and the per cent. of heat lost will be .12, provided the density of the feed water is kept at $\frac{1}{32}$, and the temperature of feed water is 100°, as follows:

S=1202° T=100° t=20+14.7=259.1—100=159.1. E=1.

Then $\frac{1202°-100°\times1+159.1}{159.1}$=7.9 proportion of heat lost.

1202° - 100° +1 +159.1=1261.1 and $\frac{159.1}{1261.1}$=.12 per cent of heat lost.

S represents the sum of sensible and latent heat of water evaporated, T temperature of feed water, t difference in temperature of water blown off and that supplied to the boilers, E volume of water evaporated proportionate to that blown off, and represented as 1. Will some of the young engineers please try and find the error in this calculation, and oblige? STARTING BAR.

Corning, N. Y.

Strength and Dimensions of Floor Beams.

Editor American Machinist:

In looking over No. 47, of the AMERICAN MACHINIST (of which I am a regular reader), I became interested in an article on the "Mill Floor and its Supports," read by C. J. H. Woodbury, before a meeting of the American Society of Mechanical Engineers. I think the article a very useful one, but think the formula on the strength of beams and the table for dimensions incorrect, and apt to mislead inexperienced constructors.

Though the construction of the formula is right, the moduli for strength and elasticity of timber, which are introduced therein, are much larger than the best authorities give, and than my own experience leads me to think proper.

The modulus for ultimate strength of Southern pine is in general given: R = 6400 to max. 7,000, instead of 12,000, as in the article; for elasticity, E = 1,420,000 instead of 2,000,000.

When I want a strong, stiff, and durable floor, I do not allow a strain of over 810 lbs. per square inch of section; for structures like warehouse floors, where some deflection is not injurious, not over 1,000 lbs., and I consider a strain of 1,200 lbs. per square inch as reaching the limit of elasticity, which must not be exceeded.

Some years ago I was called upon to examine a storehouse floor which broke completely down under a load of cotton seed, stored in bulk. I found that the strain per square inch on the joists, cannot have exceeded 4,000 lbs. per square inch of section, and though the floor had been in place some 12 years, I could not discover any very bad defect in the timbers, though the construction of the floor in general, was not all that could be desired.

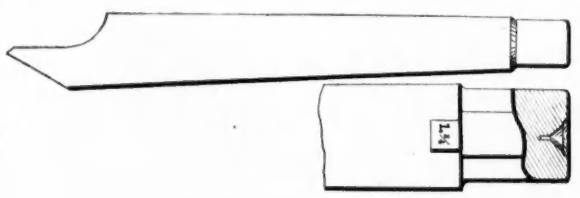
Any floor, constructed with beams of the dimensions given in the table, I think, will be a very weak one.

The second floor of a cotton mill in this city, which has 42 ft. clear, and is laid on cross beams 7″ x 14″, supported in the middle by 6″ x 6″ posts, and 8 ft. between centers; the floor is formed of one layer of 3-inch plank, with a top layer of 1¼ in. tongued and grooved flooring plank laid diagonally. When the machinery is in motion the floor is vibrating perceptibly, though I do not think that the weight from machinery and men exceeds 25 lbs. per square ft.; in this case a 6″ x 12″ beam, which the table indicates, would be evidently a failure.

About two years ago I had to erect another similar building along side the one just mentioned, and also of 42 feet clear width. At the request of the proprietor, I put the cross beams 10 feet between centers and made them 8″ x 14″, supported in the middle by 7″ x 7″ wooden columns; the floor is formed of joists 8″ deep, reaching over three bays, joints broken, and covered with common flooring. This floor is stronger and stiffer than the old one with one-fourth less timber; though I am sorry I did not increase the width of girder one or two inches, in spite of such timbers being hard to get, and expensive.

Mr. Woodbury is made to say: (though I think this is a mistake by the reporter) "*In cotton machinery a deflection of $\frac{1}{1200}$ of an inch agrees with the precedents of good construction.*" This, probably, ought to read $\frac{1}{1200}$ of the length of beam; though even this is not attainable for long beams, for which a deflection of $\frac{1}{500}$, and in many cases $\frac{1}{400}$ must be admitted, unless it is practicable to introduce compound framed beams.

AUGUSTUS SCHWAAB,
Savannah, Ga. Architect and Engineer.



Use and Abuse of Mandrels.

Editor American Machinist:

In Mr. Lyne's article on the above subject he states, that in most of shops that he has been engaged in, he has often noticed the careless manner in which mandrels are used, and that it has attracted his serious attention in an effort to remedy the evil. Again, he states that he has seen standard mandrels destroyed upon the first job by workmen who take a piece of copper, and with a heavy hammer strike a smart blow. This treatment, he says, completely spoils the center and destroys the accuracy of the mandrel.

By reading his article, I am led to believe that the mandrels he has seen so quickly destroyed must have been made in an inferior manner. As I am led to believe from practical experience that proper attention is not given to the selection of steel for such an article, and that proper attention is not given to its construction, I should like to say a few words about their construction and use. If there is a tool in the shop that receives more hard usage and punishment than the mandrel, I should like to know its name. In the shop where I have worked anything was good enough to make mandrels of, which is a mistake of the gravest kind, as experience will prove. In selecting stock for a mandrel, use the *best tool steel*. It is the cheapest in the end. Turn as hard as possible, unless the mandrel is to be hardened and ground. Center-ream the ends until they are good and deep, then with a side tool cup the center (see drawing) below the surface that is squared, so that when the ends are hardened there will be no danger of denting the part center-reamed. Above all, be positive that the center-reamer is made exact to the center gauge. Here is where a great amount of trouble arises, by not having the two exactly match. This, I regret to state, is too often the case. Upon the largest end mark the size. When driving into a piece of work use a short round rod of brass, with a hole drilled in the end. This will protect the center from injury.

If it is not out of place in this letter, I would like to say a few words about the half center, for use on the engine lathe. But few shops have it in use, therefore I should like to introduce it to your readers, in squaring up the ends of work and cupping the mandrels. As by milling a part away it exposes nearly one half the part center-reamed, it will be seen how useful it is in cupping the ends of mandrels; as by its use the spindle does not require to be slacked back for the purpose of allowing the tool to enter the part to be cupped. The usefulness of the half-center will become apparent upon once using them.

C. E. SIMONDS,
Grant & Bogert,
Machine Tool Works,
Flushing, L. I.

Fitting a Key.

Editor American Machinist:

There are "rules, and rules," for the fitting of keys, bearings top and bottom, bearings on sides, bearings in middle, bearings near ends, and, perhaps sometimes, bearings as they happen to come, when the rule is made afterwards. In the shop where I learned my trade, the general rule was, "Bearings top and bottom, near ends, sides all clear, use wide keys."

The wide key was no doubt used, on the supposition that a key does its work on the same principle that a wrench holds or turns a nut.

The bearings near ends, may, for all that I know, have been suggested by sundry loose fits. One day I had a job of keying on a saw-mill crank for Old Uncle Peters, who lived up among the Catskill Mountains. He did not have to make a yearly pilgrimage to this brain-restoring Mecca, for he lived there all the time. Uncle Peters stood by while I was at work, and I supposed he meant to hurry up the job. I changed my mind afterwards.

When I had driven the key for the first trial, he took a look at it, and very quietly remarked that it did not fill up on the sides. "Yes," said I, "clears nicely on the sides," and then went on to explain to him about the proper bearings of keys. I had an attentive listener until I was through. Then he said, "A key should *fill* the hole. That key will not do it." He put a decided emphasis on *fill*, and on *that* key. Knowing that the man who pays for the work, is entitled to have it done as he wants it, I had another key forged, and started again; but in filing it I got it too narrow. I say "in filing," because I did not then know what a handy tool a scraper is in fitting a key. I had to begin over again, as Uncle Peters insisted that it did not fill the hole. I do not now recollect how many keys I made, but I finally got one that was accepted. I never heard of the key afterwards, but I have never forgotten the rule, and have found it a good mark to aim at. I have the case of another key in mind, but it will keep, and may, perhaps, serve as the drift of another letter.

Defiance, O. OLD JOUR.

Priming in Steam Boilers.

Editor American Machinist:

In your issue of November 26, 1881, T. G., of New York, asks for a remedy to prevent the water rising in his boiler. I was once troubled the same way. Let him make the steam connection of his water gauge to *top of boiler*, instead of steam dome, and the difficulty will be overcome. After T. G. tries this plan let us hear from him, through "Letters from Practical Men."

Dubuque, Iowa. A. H. GOFF.

Loss of Power in Screw Propulsion.

Editor American Machinist:

Not being able to attend the meeting of the society at which Mr. Root read a paper on "A New Method of Screw Propulsion," I had no chance to discuss it before seeing it in your issue of Nov. 26. How any engineer could advocate such a system of screw propulsion is beyond my comprehension.

I can assure Mr. Root that he is much mistaken, not only in regard to the amount of power he can save by his new mode of propulsion, but also in the amount of power lost by the old method; and, further, that the mode he proposes is not new.

I have the drawings that were submitted to me by a party a few months ago, asking my opinion of this very mode. He had built a vessel of about one hundred tons, and had tried it some ten years ago, and he told me that the amount of coal used during a run from New York to Buffalo was over eighty tons. Mr. Root's entire paper seems to be a misconception of the true principle of screw propulsion, for he seems to be impressed with the idea that if a reacting medium has acquired a previous velocity, that this velocity is a disadvantage to its further reaction upon the propelling instrument through which it may pass, when the reverse is really the case, from the fact that its reaction depends upon the quantity passing through it in a given time. If a screw imparts a velocity to the water in advance of itself, it must do this by creating a difference of hydraulic head, which is the cause of this velocity. In this case the screw must have a pressure upon its disc of so many pounds per square foot, in addition to that of the reaction of the stream taken from a point at which it enters the screw, which would make its reaction the equivalent of that of the whole stream and its velocity. Mr. Root gives Rankine's formula for finding the pressure upon the propelling instrument, and in working an example according to this formula makes the mistake of taking the pitch of the screw for the speed of the ship.

It is a wise plan to find out how much we have lost before we begin to talk of how much we can save, and Mr. Root seems to be impressed with this important fact, for further on he says: "I believe it is conceded by eminent engineers that the loss by the present system of screw propulsion is between fifty and sixty per cent. of the power. It is my opinion the power required to propel a vessel a given distance at a given rate of speed by either of the following methods, would approximate:

Tow line,	1.00,
Cyclodial Screw,	1.33,
Horizontal Screw,	2.00.

With a screw of only 14″ pitch, with axis at 60° incline, 180 revolutions propelled the boat 360 feet, the travel of the pitch of the screw being only 210 feet. Here is a solution of the negative slip problem. In Burgh's book on the screw propeller, there are numerous cases given where the speed of the ship was greater than the progression of the pitch of the screw."

I find that Mr. Root is the only man who, to my knowledge, has discovered a saving of power in negative slip, and he is certainly entitled to a patent for this discovery. In every case of a screw having negative slip, with which I am familiar, it was found that by substituting a screw that gave a considerable positive slip, the same vessels, under the same conditions with the exception of slip, would show an increase of speed for the same power applied.

Now, in regard to the concessions of eminent engineers, I know of many who will not concede any such loss as 60 per cent. of the power, in the face of so many well-established cases in which the loss by the propeller was not more than 8 per cent. of the indicated power of the engines which drove them, nor more than 14 per cent. of the actual power applied to the screw. Even Mr. Rankine, 15 years ago, states that 60 per cent. of the power was surrendered to the ship. In the propelling of vessels by the reaction of a yielding medium, the loss by slip depends almost entirely upon the relative resistance of screw and hull, and by varying this relation we may have the loss anywhere from 9 to 90 per cent.

I think that Mr. Root has made a mistake in presenting Mr. Emery's letter as advocating a saving of power by his mode of propulsion. Mr. Emery, in his letter, talks of a greater force acting through a less distance driving a smaller force through a greater distance, but he does not say one word in regard to a saving of power. I believe Mr. Emery to be too learned a man to claim a saving of power from this mode of screw propulsion.

From Mr. Root's most singular opinion, we find that he supposes that we use a horizontal screw, which loses 100 per cent. more than

the "Tow Line," of which loss, he proposes to save 66 per cent., by substituting the cycloidal screw, when he might save 85 per cent. by a proper proportioned screw of the old kind. JOHN F. ALLEN.

Truing up Work on Face plates in Lathes.

Editor American Machinist:

It is the common practice of many machinists (some of several years' experience) in laying off work that is to be bored accurately on the face plate, to use a large, blunt center punch, then describe a circle equal to the diameter the job is to be bored; prick punch the circle in several places, and proceed to chuck to the face plate, and true up by a scratch awl in the tool post. Such an operation may do for *some work*, and for some shops, but work so done will not be true—only approximately.

I remember seeing a machinist (?) lay off a pair of dies for a drop hammer in a mowing machine shop. Said machinist put immensely large center-punch marks in the dies, then brought the tail stock center up tight in this large center; clamped the job and bored it out. It is useless to state how the drop forgings looked that came from that pair of dies.

Please allow me to suggest a very good plan to lay off work, and true up the same, as practiced in many well-regulated shops. All work should be planed before being laid off, when possible; then lay the work off with *fine lines*, using a small fine-pointed center punch, and describe a circle equal to the diameter the job is to be bored; also describe another circle a little larger, as a *safety mark*, in case the job should by accident or otherwise move after the center is out. Next, chuck the job, and proceed to true it, using a straight piece of Stubb's steel (round), $\frac{1}{8}$" diameter, and about 12" to 14" long. Center one end, and grind the other similar to a scratch-awl; place it between the center of the lathe and the small center punch mark in the work; true up till the *point stands still*, and you have a true job.

By the use of this little steel rod a very slight error may easily be detected, and will consume no more time than truing by the circle. In my next I will say something about the use and abuse of lathe shears.

VERBUM SAT SAPIENTI.

Springfield, O.

The Lifetime of Steam Boilers.

At the last meeting of the American Society of Mechanical Engineers, Mr. W. Barnet Le Van read a paper on "The Life of Steam Boilers," in which he contended that there should be a prescribed limit to the time a steam boiler is allowed to remain in use. Boilers pass from hand to hand (after being overhauled and repaired if necessary) and are used until their life is exhausted, even though appearing sound and serviceable. He advised the enactment of laws prescribing ten years as the limit of a boiler's life, requiring them to be condemned at the end of that time. We have thus far been unable to obtain a copy of the paper for publication. A brisk and interesting discussion followed the reading of the paper, from which our stenographic reporter took the following notes:

Mr. F. B. ALLEN.—While I think it a very desirable matter if there could be any arbitrary way by which the safe usage of a boiler might be defined, I cannot understand, practically, how anything of the kind can be done without doing a great deal of injury. The safe usage of a boiler, in my mind, is determined by three or four practical considerations—the design of the boiler, the material and workmanship, and the manner in which it is managed. It is unquestionably the fact that there are new boilers turned out that are utterly unfit for the purposes for which they are built, and should be condemned. I have personal knowledge of a number of boilers that have been used for a great many years; and, as far as can be determined by known tests, such as are relied upon by engineers to determine the strength and durability of boilers, are fit for the purposes for which they are used to-day. Our President pointed out more than twelve years ago, at the time of the Westfield investigation, if I mistake not, that to some extent the same principle that was employed in ordnance might be employed in steam boilers; that is, that after a certain length of time it should be condemned. It seems to me that, if that rule was to be enforced, it would work a vast amount of injury. The gentleman who so ably read the paper has not pointed out, so far as I understand, anything in which we can place greater reliance and more faith than our present system of boiler inspection. It is a very difficult matter to determine the matter of crystallization in boilers.

In all that I say here I desire to be understood as speaking in my individual capacity. A case recently came under my observation in which a boiler had been used in the City of New York for the past twenty-four years, yet there was no appreciable reduction by corrosion. That boiler seemingly is in good condition as to outward appearances, and it has safely stood the water-pressure test and the usual means of testing, and it is undoubtedly in good condition to-day for a great many more years; yet, simply as a precautionary measure, the boiler was taken out. A great many of these cases are constantly occurring. I recollect distinctly within the last year of some experiments being made at the Watertown Arsenal; strips of iron cut from a locomotive boiler—certainly subjected to a much more severe usage than that of any stationary boiler, and yet that plate showed a great amount of elasticity that would have made it acceptable if it was to be used over again. There are so many facts and considerations that come in and affect the case that, if any gentleman has a plan by which we can do better than rely on the best skill of skilled inspectors to make examinations and prevent explosions, I, for one, would like to know what it is.

Mr. LE VAN.—My object in writing this paper was to meet the very point this gentleman makes. After an explosion in the mill of Wood Brothers, at Philadelphia, which cost a hundred thousand dollars to repair the damages and pay the cost of the Widows' Court suits, these very boilers that remained in the mill were insured by the insurance companies in the face of that. The fact of a piece of iron showing a good test is no proof at all that the boiler is good. No living man, however expert he may be, can tell where the point of danger commences. Had Wood Brothers put new boilers in at the end of ten years, they would have saved a hundred thousand dollars. I say that the only way is to limit the time, because we do not know that iron will last twenty years by boilers in use; and if we cut the time down one-half, we have that additional risk in our favor. I am sure that any manufacturer that can afford to pay for losses by explosion can afford to buy new boilers.

Mr. F. B. ALLEN.—I cannot see how any arbitrary rule can be laid down to strengthen the security of a boiler, depending as it does on so many practical conditions. A boiler after ten years of service might be very safe. There are a great many new boilers that explode, as well as old ones.

Mr. PIERCE.—I am not a member of the society, but I should like to ask one question of those members that are experts. Some time since, in inspecting the fragments of a boiler, I found that many of the holes were punched for rivets something over an inch in length. I made very careful tests of the specimens which were taken from each one of the plates, and found that one of the plates was three-eights in thickness, and the inner plate was originally five-sixteenths, and that the inner plate would stand a test on an average of forty-eight thousand and some hundred pounds, whereas the thicker plate only stood a strain of about twenty-eight thousand; and the thick plate was brittle, whereas the thin plate was found to be very pliable, and in excellent condition. The boiler must have been used twelve or fifteen years. The question in my mind was, whether that boiler was not just as likely to explode when it was first put in as at the time of the explosion. The punching and workmanship were such, in the process of manufacturing, and the boiler was so carefully put together, that it seems to me it would be utterly impossible to arrive at any decision in regard to the question of time.

Prof. HUTTON.—It has been my custom, in discussing the subject of the wear and tear of boilers in service, to classify the wear and tear in two great divisions; the wear and tear which was preventable, and that which was inseparable from the way in which boilers are customarily hung, and from the necessary variations in pressure to which those boilers are exposed when heated during the day and cooled at night. At night the boiler becomes oval with the pressure reduced, from the weight of the water in the boiler during the day, and when the pressure increases the boiler returns to its cylindrical form. There is necessarily, therefore, at all those points a bending strain. Of course those familiar with inspection know the phenomenon of moving, which results, no doubt, from that very fact occurring regularly day after day. We have similarly got to assume that there is something corrosive in the water to make the boiler, by the very fact of its daily use, change into a condition where only an inspection can render it safe. Then, of course, there is the longitudinal flexion of the shell; when it is cold at night it assumes a certain position, and when the heat is applied the tendency is to either slack up or the reverse. Those are entirely unpreventable, from the necessities of the generation of steam, and it is possible, perhaps, for us to fix a limit at which it would be unsafe to use a boiler from the simple matter of age, these processes having gone on long enough to produce an effect analagous to crystallization. But there are things over and above all these—unpreventable ones—such as careless stoking, which may occasion these processes, and while the normal use of the boiler might not wear it out in twenty years, these will render the boiler unsafe after it has been used one year. It seems to me that last question is one that ought to be discussed with regard to the life of boilers.

Mr. ROOT—Mr. Le Van's suggestion as to the time which shell boilers may be used is a very wise one, but there is another way of avoiding all this danger: that is, by encouraging the use of boilers that will not explode—*sectional boilers*. That is the true solution of the problem. I think there are very few uses to which steam boilers are applied but what the ingenuity of man is sufficient to produce a boiler upon that principle. I think that is the only way in which steam will ever be used without danger.

Mr. LE VAN.—I would like to ask the gentleman whether such a boiler would not be liable to explode.

Mr. ROOT.—Even if it did explode it would not do any harm. You take a boiler made up of a number of small compartments and there is not enough explosive force in any one of these compartments to produce any great destruction. I do not say that a man might not be scalded, or something of that kind—that would take place with a tea-kettle; but you can get rid of these explosions that blow down buildings and deal destruction all around. The true remedy is to go in for the sectional form of boiler. It can be applied to all the uses for which the steam boiler is used, providing the proper amount of attention is given to it. We hear this question of boiler explosions discussed all the time, and still we seldom hear anything said in favor of the sectional system. That is the only effectual cure for steam boiler explosions. It is a thing that is not only possible, but probable. The passage of some law by which boilers should be made in a form that they could not explode, would be the wisest plan, I think.

Mr. F. B. ALLEN.—The matter of design enters largely into the safety of boilers, and while we make the vessel in which the steam is generated very safe by making it of a sectional form, there seem to be practical disadvantages in consequence of defective circulation and lack of disengaging surface for steam and other practical questions that come in, so much so that it has retarded the introduction of such boilers as the gentleman describes. They have been successful in a great many places, but we find that they are objected to on account of the difficulty of keeping them tight and the varying expansion; so that the question has narrowed itself down to getting a boiler the design of which shall be such that it shall be made as safe as possible, and give us the requisites of a good boiler in the necessary fire surface and disengaging surface for the steam.

Mr. ROOT.—I do not think that it is the imperfections of the sectional system that have retarded its general introduction so much as other considerations. We have the large rolling mill interest that rolls the plates for the boilers and the insurance companies that insure them. But I believe if the the thing is looked at fairly, that the result produced by the sectional form of boiler has been as good as ever was produced by any other form. So far as durability and cost are concerned, it is as good. The only thing is that the large amount of money invested in the construction and use of the other form has outweighed to prevent the introduction of an entirely safe boiler constructed on the sectional plan. What we are after in steam boilers is safety, and that is the only road by which it will ever come. It will come in time, but it will be when these obstructions have gradually worn away.

Mr. COTTER.—I wish Mr. Le Van had been a little more explicit as to the time of the life of a boiler. I am not a boiler maker nor an insurance man, but I look at boilers sometimes. Take the practical illustration of a locomotive boiler that I was called to look at this past week. The boiler was made in 1868, and ran for six months. It has been taken the very best care of, according to the best known practice; and what shall we do with that boiler? It has not been fired for over ten years. When would the life of that boiler cease? I agree with Mr. Allen. I no not think you can tell when the life of a boiler is going to terminate definitely. It depends a great deal on the care with which it is used and the water that is used in it, and upon a great many other things. Now, for the remedy being of a sectional type, it is entirely impracticable to use the sectional boiler in all conditions. In speaking of boilers, I think we may assume that we are speaking about cylindrical, or shell, boilers, and what we want is to get at some definite way of making them more secure. There are conditions where a sectional boiler cannot possibly answer the purpose of the manufacturer. I know it; and a great many of these people are practical men, and they know it. I think Mr. Root could call to mind some conditions where a sectional boiler could not be made as applicable as the other type of boiler. The English Board of Trade tried to establish a law, I believe, some time ago—and I thought it was a very good one—that a boiler standing a test of 50,000 pounds, after being used ten hours a day for sixteen years, should be put out. Something like that is what we want; there is no greater need of any fixed law or fixed rule to go by than something like that. I know boilers that have been running twenty-five years, and I cannot condemn them, because I do not know what to say. I think the best thing we can do is to inspect them as well as we can under the present system, unless somebody will tell us some other way, and a better one.

Mr. WATSON.—It seems to me that the only remedy for this matter that the members have touched upon is thorough care, examination and inspection in all parts and at all times. I can call to mind numberless instances where boilers have been used severely, and are just as good practically to all intents and purposes at this day as the day they were first put into use. Such a pair of boilers is now on the steamer Old Dominion, of the Old Dominion Steamship Line. They have been in use now ten years. I saw those boilers the other day, and made it a point to go through them. They have been in charge of a practical engineer, who is a capable man. There is not a particle of scale anywhere about them, and to all appearances they are just as good now as the day they came out of the shop, and I believe, from what I have seen of them, they are as good. The mischief lies here: If you say to a working engineer that his boiler is liable to fail at any time from a crystallization of the iron, you put him in constant fear all the while, and you say to him practically that it is no matter at all what care he may take of his boiler, that it is liable to fail at any time through these inherent defects in the life of the article. It is detrimental to the interests of the steam engineer, in general, that a man should be told that his boiler is liable to fail at any time. It seems to me the true remedy is thorough inspection and care and practical knowledge.

Mr. LE VAN.—My object in writing this paper was based on the use of boilers as ordinarily inspected. If boilers were made as they ought to be, there would be no limit. Where is the boiler that is thoroughly made or inspected? Point me out one in this city! If we do not have a law to limit the time, we must have a law to make people inspect them. They do not do it. The inspection law, as far as it goes, is well enough; but *it is a farce*, from the fact that it is not carried out.

Mr. L. F. LYNE.—I believe a boiler ought to be renewed when it gives evidence that it is dangerous. I claim that a boiler should be so set that all parts of it would be accessible for inspection and repairs. A few weeks ago I saw a boiler taken out, in the lower part of this city, that was said to have been in use twenty-four years, and I believe from examinations made, so far as I could see, that the new boiler put in was far inferior to the one that came out. I have known a set of tubes in an upright boiler to have been completely destroyed within two months from the time the boiler was set, and one of these tubes is in existence at the present time as a specimen. There was a process that took place in those tubes which is commonly known to engineers as pitting, which proceeded with such rapidity that within two months' time the tubes were rendered useless and had to be replaced. I think the proper way to determine the life of a boiler is to thoroughly inspect it. I had occasion recently to inspect a boiler in Jersey City, where there is no law that requires even a safety valve to be put on a boiler, or any other safety appliance. The great difficulty and the true cause of the evil is in not having proper legislation requiring proper settings, fittings and examinations of boilers. Manufacturers look at the dollars and cents, and if you talk to them about pulling down their brick work to inspect their boiler they will start you out of the place very quickly. We want proper legislation and a rigid enforcement of laws enacted requiring inspection, within certain limits, to see whether boilers are in proper working order or not.

Newspaper men are, after all, subject to trials, as well as ordinary mortals. The paragraphist of a daily paper feelingly complains that after patiently wading through a column article, headed "A Successful Spark Arrester," he didn't find a word about Mary Anderson or Clara Louisa Kellogg, and comes to the conclusion that a large quantity of good printer's ink was wasted in describing "some confounded thing to be attached to a locomotive."

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NEW YORK, DECEMBER 10, 1881.

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The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

Writing on Mechanical Subjects.

There are many mechanics who possess useful knowledge of shop processes that would greatly assist others in like occupations were the facts written out and published. But most of them are reluctant to communicate this kind of information to technical journals, because they are afraid of making mistakes in spelling, or in the use of words and phrases to express what they mean. It may console some who have been hesitating about sending a few notes on one or another mechanical topic to the AMERICAN MACHINIST, to know that correct grammar and spelling are by no means universal among well-informed writers upon mechanical subjects. It does not follow that because a man can not write a smooth and elegant hand, and spell every word correctly, that his ideas are not worth publishing in our columns. We never send an issue to press without previously correcting a number of literary mistakes in contributions, but these things give us no trouble to speak of. We only ask for correct mechanical particulars, and that communications shall be plain enough for us to understand the ideas they are intended to convey. The following letter, just received, may be taken as an example to illustrate the point considered, as well as one or two other points that frequently arise:

Your publication having become what I presume its projectors proposed—the practical mechanic's mental exchange—permit me to occasionally subscribe an article of maybe-useful information, learned from or proved by actual experience; and, although I would by no means condemn or discourage communications of a hypothetical tendency (for of such come facts), every one must be delighted with the *reliable* information obtainable from a reference to the work in question.

However much information a practical individual may possess, he will generally allow he does not know everything, and will also admit that altho' an idea or plan may be and is perfectly original with himself, it may at the same time have been known to and used by even his *neighboring* craftsman; so very meagerly has "Exchange" been taken advantage of compared with its uses and importance. We must, therefore, not be surprised if, under the impression that an idea given is novel, we may sometimes—aye, often—submit one that is "Old as the Hills" to some. It will perhaps be admitted, however, that the intention is good; for I think and have no doubt there is a modesty existing amongst working men that causes much procrastination, if not actual inaction, in communicating "kinks" or hints, which they willingly and cheerfully would do, were it not for the (no doubt in most cases false) fear of being snubbed for pedantry, or criticised for clerical style or errors. Permit me, therefore, to arm myself by requesting you to kindly admit what may be novel and correct, correct what may be useful and instructive, and reject the useless or irrelevant of any communication you may receive from me.

We shall be pleased to hear frequently from the writer of the above letter upon practical mechanical matters, and will treat his communications as he has requested us to do. A writer who has some really useful and not generally known facts to write about, need not have any fear that his letters to us will not receive favorable consideration. We are always ready to welcome such communications, whether abounding in the most elegant language or composed in the everyday style of shop expressions. The main thing that makes them acceptable for our columns is the *idea*, not the penmanship or the spelling. Anything amiss about the latter is easily made right before going into print.

In this connection we present the following extract from a letter from one of our London readers:

The "screw-cutting device," ably described in your issue of September 24th, is an old workshop "wrinkle" on this side. It is referred to in "Turning and Mechanical Manipulation," Vol. IV., page 391. Although rather of the workshop order, it is very decidedly useful in default of better apparatus, and the noting of such little practical matters is a valuable feature in your excellent paper.

The device mentioned was not presented by us as *new*, but as one not generally known and used in this country. The fact that the cut and description was afterwards reproduced in the columns of *Engineering*, the leading journal of its class in Europe, gives some evidence that the device is no more common on the other side of the Atlantic than it is here. There are shop kinks and devices in general use in certain localities which are unknown to most mechanics. The publication of many of these would be of decided value. Let no one be restrained from sending notes of such matters to the AMERICAN MACHINIST, notwithstanding in a few shops they may be familiar to every workman.

Restricting Prison Competition.

Last winter the New Jersey Legislature passed an act limiting the number of State prison convicts employed in any single branch of industry to 100. This law was assailed by those who believed that the almighty dollar is of more consequence than the prosperity of free working mechanics. Serious losses to be met by the taxpayers were predicted. The result has been that all the prisoners are employed. In seven different trades the earnings are at the rate of $10,000 a year more than they were under the old system. Two years ago the manufacture of hats in the New Jersey prisons was forbidden by law, as it seriously interfered with those engaged in that trade throughout the State. Wherever the employment of prisoners in any branch of industry works injury to free labor, the evil should be remedied by law.

Unskilled labor is likely to have a struggle against low wages and high cost of living this winter. Prices of the necessities of life have advanced fifteen to twenty-five per cent., but wages have not. Skilled mechanics, on the other hand, have all they can do at good wages. Young man, learn a trade, and learn it *well*.

Special Education.

There is nothing particularly suggestive of art in the appearance of an ordinary crowbar, but as they are produced they represent the work of an educated man. Such a tool—a tapering bar of steel—is, besides the point, made up of three distinct forms; beginning with a square, continuing with an octagon, and concluding with a round section. Looking at a pile of a hundred or more as they come from the hammer, it is a difficult matter to detect difference enough to distinguish one from another. This would all be simple enough if they were forged by the aid of dies, but the fact is that their correctness of shape depends entirely on the skill of the individual who presides at the hammer. There are a thousand ways to make them unlike, and only one to make them alike; yet each of the three forms is merged into the succeeding one, with a correctness that would do credit to a draughtsman, and the sizes are kept so nearly perfect as to require close measuring to find where one differs from another.

Of course, it is easy enough to see how such things may be done if plenty of time is allowed; but perhaps the most wonderful thing about the forging of this simple tool is the fact that it is all done in from two and one-half to four minutes.

Any man who, with no guide but his eye, can do such work as this, and in such time as this, does it by virtue of a high education, of a practical and valuable kind.

Our Trade with Mexico.

The trade of the United States with Mexico, which is $6,000,000 this year, under the new impulse of general progress in the latter country, should rapidly increase. Machine manufacturers in this country will do well to look sharply after this trade, as one of the great demands of Mexico will unquestionably be machinery. At present one-sixth of the entire trade is done by New Orleans.

An inventive genius, falling in with the current of thought, proposes to utilize the forces of Vesuvius. We suggest it would be a good place to boil the pot for an international co-operative cooking establishment.

Atomizing Minerals and Other Substances.

At the Continental Iron Works, near this city, may be seen at work, experimentally, a novel machine called, and very appropriately, an atomizer, the use to which it is put being to atomize any known substance capable of being brought to such a condition by other processes than cutting. The machine consists, essentially, of a hollow cylindrical shell, about five feet in diameter, mounted on a shaft which is adapted to revolve in boxes, being driven, ordinarily, by a belt or gearing, although, for convenience, the one at the works is driven by a pair of oscillating engines. The material to be atomized is fed in at the center, and carried to the outside by centrifugal force, where, by acting against itself, it is brought to the condition of a powder, the degree of fineness of which is determined by the operation of a small fan connected to the interior of the shell, and which is run faster or slower according to the degree of fineness desired. This fan operates, by regulating the tension of the atmosphere in the case, to float the atomized material out through a pipe, the continuation of which is a large upright vessel, in which it is allowed to settle. The fact that the particles will not float under a definite pressure if of more than a standard weight, provides for a perfect uniformity of the product, and although the operation of the machine is hardly explainable, it seems to be a fact that almost any substance may be atomized by this means faster than by any other known process. The speed of the machine is only about eighty revolutions, and is, we believe, the invention of Mr. Duc, of South Carolina.

Clark University, Atlanta, Ga., has a practical industrial school connected with it. The School of Carpentery was begun last year. The President, Rev. E. O. Thayer, writes us: "The young men, with the aid of the Superintendent, built a neat two-story shop. In the first story are two benches, furnished with common tools; a scroll saw and a lathe, the former a present from W. F. & John Barnes, Rockford, Ill. Our purpose is to make practical carpenters and blacksmiths. Some of the pupils made good wages last summer. The instruction is given in connection with regular courses of study. The institution is supported by charitable people in the North, for the freedmen especially. We have lectures from an experienced architect, and the boys built a pretty cottage of seven rooms last summer for one of the professors."

The Journal of the American Agricultural Association, published at 127 Water Street, New York, and which has hitherto appeared semi-annually, has been changed to a quarterly, and presents in its present issue 258 pages of substantial reading matter that cannot fail to interest and instruct its readers.

This publication proposes to discuss all questions of interest to those engaged in agricultural pursuits. In its present table of contents we notice such subjects as the Railroad and the Farmer, by Hon. L. E. Chittenden, and by Edward Atkinson; Electric Horticulture, by Dr. Siemens; the State of Agriculture in England, by Prof. I. P. Sheldon, as well as a large number of practical subjects treated by well-known authors, many of which are singly, we have no doubt, worth the subscription price. Altogether, if the enterprising publishers continue to give an edition of the present size and interest for the present price of two dollars a year, it will be a matter of considerable surprise if it does not receive a liberal support.

The Southern saw palmetto, it is now said, furnishes material for the manufacture of a very superior quality of paper, such as has always been imported. We understand that the manufacture of this paper, on an extended scale, will be shortly commenced at Savannah, Ga.

Seventy patents were granted to women in 1880. Not one of them was for a rotary engine or a perpetual motion machine.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(1) A. B. D., Tonawanda, N. Y., asks: 1. How can I make a cheap electric battery? *A.* Consult any work on Natural Philosophy. 2. Is there any way to work the following problem: A certain engine, 12″x16″, with 100 pounds steam, makes 75 revolutions, the throttle being open 2″, and with the throttle open 3″ it makes 100 revolutions: how many revolutions will it make with the throttle open 5″? *A.* No; there is no way to determine this but by actual experiment. 3. There is a boiler made of ⅜″ iron, 8 feet long and 52″ in diameter. About how much would it expand 4 feet from each end, at a pressure of 100 pounds per square inch? *A.* We suppose you mean to ask how much it will expand each way from the center, which will be about 1-10″. 4. What is the tensile strength of ⅜″ plates of iron and of steel of an average quality? *A.* Iron about 55,000 and steel about 60,000 pounds per square inch of section.

(2) J. J. B., Montreal, Canada, asks: 1. Is it possible to cut a screw of 3 threads in $\frac{13}{12}$″, in a lathe in which the lead screw is 4 to the inch, and the change gears are 28, 32, 40, 42, 48, 48, 36, 72, 80, 88, 96, 105, 112, 130? *A.* No. 2. Can it be cut in a lathe in which the lead screw is 3 to the inch, with gears from 20 to 120, advancing by 10? *A.* No.

(3) F. A. S., San Francisco, Cal., asks: Will you please inform me how I can obtain admission to the cadet engineer department of the navy? *A.* Write to the member of Congress from your district.

(4) J. R. B., Lowell, Mass., writes: I want to cut a worm wheel 18″ diameter, 5 pitch. Can I do it with a hob in the lathe, and the gear arranged on a stud in the tool slide? *A.* Yes; by first marking or partially cutting the gear in a gear cutter, you can finish it with the hob. It will probably be necessary for you to arrange a support for the rim of the wheel to bear against near the cutter. We know of no better way to make a correct worm wheel.

(5) W. H. D., Branford, Conn., asks; 1. What the word "pitch" means, as applied to the teeth of gear wheels? *A.* The pitch of a gear is the distance from center to center of two adjacent teeth, measured on the pitch line. 2. Will you tell me why a pulley balanced at rest is not in balance when running? *A.* See "Balancing Pulleys, etc.," by George M. Chordal, in AMERICAN MACHINIST, August, 1878.

(6) D. S., Scranton, Pa., writes: I am a locomotive fireman, and would like to ask: 1. What is the squealing noise the engine makes at every exhaust when working hard? *A.* We cannot tell at this distance—perhaps not, if nearer. As a suggestion, perhaps it is the friction or action of the exhaust steam on some of the ports or passages. 2. What is meant by a balanced valve? *A.* A valve that is relieved of a part or all of the pressure of steam that holds it to the seat. 3. Where in New York can I obtain a license as an engineer? *A.* At Police Headquarters, Mulberry Street.

(7) A. S. C., Conshohocken, Pa., asks: Please tell me how much oil should be used in 12 hours in a slide valve engine cylinder 25″x48″, running 42 revolutions; also, how much in one with cylinder 28″x48″, running 53 revolutions. *A.* Much depends on the quality of the steam. Probably about one pint in the first-named engine, and one-third more in the other, that is, if you have an approved way of feeding.

(8) P. W. K., Boston, Mass., writes us that he has devised a means of reversing a locomotive, using only one eccentric to each cylinder, and asks us as to its value? *A.* Such devices are old, and as you say you cannot vary the expansion, there is not the least probability of yours being of any value.

(9) I. B. B., Philadelphia, Pa., asks in reference to a locomotive built by the Baldwin Locomotive Works to make 80 miles per hour. *A.* If they have finished such a locomotive, we have no record of its having made that time. 2. On what road in England is the so-called 90 minute or velocipede engine running? *A.* We believe it was not sent to England.

(10) C. B., Camden, N. J,, asks: 1. Does steam of high pressure travel faster than that of low pressure? *A.* Yes. 2. Will you give me the title of a book on geometry, suitable for a machinist? *A.* "Elements of Geometry," by Wentworth. 3. Can you give me the chemical mixture of burners for electric lights? *A.* We presume you refer to the carbons which are made in various ways: that is by mixing different substances—such as clay—with carbon. 4. What is the crushing strength of brick, and what weight will they bear with safety? *A.* Crushing strength from 500 pounds per square inch of section upwards, depending on the quality. Safe weight from ⅛ to 1-6 of crushing strength. 5. How many bricks are required for a cubic foot of wall? *A.* Bricks are made in different sizes, from 7¾″ to 8¼″ long, from 4″ to 4½″ wide, and from 2″ to 2¼″ thick. They also vary when nominally of the same size, and are laid close or open. You had better measure brick work in your vicinity and strike an average.

(11) J. H. F., Philadelphia, Pa., asks: 1. Will you give instructions, with diagrams, for setting the valves on a double eccentric link motion engine? *A.* You will find this explained and illustrated in AMERICAN MACHINIST, Nov. 1878. 2. Can the valve of an ordinary steam engine be set without removing the steam chest cover? *A.* The valve stems of all engines should be marked with a standard tram, so that the valves can be adjusted at any time, without removing the cover. When this is not done, the valve can be approximately set by placing the crank on the dead center, opening the cylinder cock, placing the valve so as to cover the ports, and then, with the throttle open, move the eccentric in the direction of its travel until the valve has lead, which must be determined by the escape of steam from the cylinder cock. In this way, if you have a correct appreciation of the movement of the valve, you may succeed in setting it with reasonable accuracy.

(12) H. K. J., Amesbury, Mass., asks: Will the AMERICAN MACHINIST please inform me of a formula for computing the width of a belt to transmit a given horse power? I have several formulas, but they differ so widely that I should like to have one that I can be sure of? *A.* We believe you are in the condition of every one else interested in the transmission of power by belting. We could quote you a half-dozen different formulas, but as you seem to be in possession of them already, it would not help you any. There is but little exact knowledge on the subject, and the condition under which different belts are run is hardly ever alike. Altogether, we presume, you are as much in the light as any one.

BUSINESS SPECIALS.

50 cts. a line for each insertion under this head.

For Sale—1 Iron Planer, Planes 8½ ft. long, 34 in. wide, 30 in. high, to be delivered in Jan. $550.00. 1 15 in. Engine Lathe, 7½ ft. bed, Wright's make, Screw Cutting, Rod feed, with counter complete, for immediate delivery, price $250.00. Both machines, in good order, are sold to be replaced with heavier. Address, Concord Axle Co., Fisherville, N.H.

An Otto Silent Gas Engine for sale; 7 H.P.; been in use 15 months, and can be delivered Dec. 1. Reason of sale: I am going to put in a larger engine of same make. H. W. Lyon, Bridgeport, Ct.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Sent free by the publisher, Jas. F. Hotchkiss, 84 John Street, N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

James W. See, Consulting Engineer, Hamilton, O.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, neatly bound in cloth, ready to ship by express, for four dollars. Unbound, three dollars. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Useful Information for Steam Users." A 100 page *Illustrated Pamphlet*. Contains interesting data on the care and management of the steam engine and boiler, and rules for engineers and firemen. The engineefs of every well regulated establishment should have this work. Sent by mail on receipt of twenty-five cents in postage stamps. The J. N. Mills Publishing Co., 165 Broadway, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. Just the thing for a Holiday gift. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 Humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

MANUFACTURES.

The works of the Freeport Malleable Iron Works, Freeport, Ill, will be in running order Jan. 1, 1882.

The Walworth Mfg. Co., South Boston, Mass., will begin operations in their new foundry about March 1st.

It is rumored that extensive locomotive manufacturing shops are to be erected in the vicinity of Montreal.

The new building, in addition to the works of the National Rubber Company, in Bristol, R.I., is nearly completed.

The Manchester Locomotive Works have just finished two locomotives for the Sonora Railway Company, Mexico.

The Sedgwick Manufacturing Company, Poughkeepsie, N. Y., employ 15 men making feeders for printing presses,

W. F. & John Barnes, Rockford, Ill., have commenced the manufacture of power lathes, in addition to that of foot lathes.

The Belcher & Taylor Agricultural Tool Co., Chicopee Falls, Mass., are building an addition to their foundry, 16×110 feet.

The Stoddard Foundry Co., St. Louis, Mo., are erecting an iron-clad building for their business at the corner of Ashley and Collins Streets.

The Osborn & Cheesman Co., Ansonia, have recently purchased ground upon which to erect a steam brass mill. Their export to Europe is large.

Satter Bros., of the Mechanics' Boiler Works, Reading, Pa., are building an addition to their works 50x26 feet, and will put in new and improved machinery.

The Chicago Screw Company, Chicago, Ill., will build an addition to their works 100x90 feet, their present quarters being entirely too small for their business.

The Newton Machine Tool Works, Philadelphia, Pa., have orders from one firm of locomotive builders for ten milling machines, and from another for seven.

H. H. Coles & Co., of Philadelphia, manufacturers of machinists' specialties, have removed to 1010 Hamilton St., where they will have greatly improved facilities.

A two-story addition is being built on the rear of the Gilbert & Barker Manufacturing Company Works, at Springfield, Mass. They will put in a new engine and machine tools.

The Madison Manufacturing Co., Madison, Wis., have increased their capital stock to $55,000, and will begin at once to build a new high-speed engine designed by Benjamin F. Wilson.

Y. M. Riser, of Franklin, Tenn., has ordered an Atlas-Corliss Engine for his 125-barrel flour mill. The mill of W. Trow & Co., Madison, Ind., has just started up with power from a new 22″×48″ engine of the same kind.

Ground has been broken for the buildings of the C. S. Williams Sewing Machine Company, at Plattsburg, N. Y. In addition to the capital of the Company, the citizens of Plattsburg have subscribed liberally to the stock.

Robert Wetherill & Co., Chester, Pa., whose shops have recently been greatly enlarged, are working with 180 to 200 men, on steam engines, boilers, etc. They are completing the organization of the new shops as rapidly as new tools can be obtained for the purpose.

Iron shipbuilding on the northern lakes is now established as a permanent industry. Cleveland claims to be the foremost port. This year her builders have launched six steamships, ranging from 240 to 290 feet of keel, and four more of equal size are under way, including a large iron steamer, building by the Globe Dry Dock Company.—*Industrial World.*

The Niles Tool Works, Hamilton, O., write us: We are running 23 hours per day, and are putting in another electric light, giving us 16 lights in all. We shipped last month a set of pulley boring and turning machinery, to St. Petersburg, Russia. Have nearly ready for shipment a 14-ft. boring and turning mill for C. H. Delamater & Co., New York, and one same size for the Southwark Foundry and Machine Co., Chas. T. Porter, Supt., Philadelphia.

Newly Incorporated Companies.

MASSACHUSETTS.

Pittsfield Iron Steel Co., Boston; J. Foster Clark-Prest., Wm. G. Bell, Treas.; Capital, $200,000. For the mining, manufacturing and selling iron and steel.

Excelsior Paper Co., Holyoke; James L. Hodge, Prest., Geo. R. Dickinson, Treas.; Capital, $50,000, in shares of $100 each. For the manufacture and sale of paper.

Laurel Lake Mills, Fall River; John P. Slade, Pres.; Abbott E. Slade, Treasurer; Capital, $400,000. For the manufacture of cotton goods.

NEW JERSEY.

Morse Rubber Company, Camden, N. J., and Philadelphia, Pa.; William A. Morse, Frank Skinner, Silas G. Wilkins, and others, corporators; Capital, $100,000. To manufacture and sell gossamer cloth, and clothing made of rubber, and machines and machinery for manufacturing the same.

Bloom Iron Mining Company, Little York, N. J., and Philadelphia, Pa.; Edward P. Carpenter, James M. Richmond and Henry B. Fowler, corporators; Capital, $200,000. To mine, mill, sell and buy iron ores; and the manufacturing of iron and transacting a general mining and manufacturing business in Hunterdon Co.

Kimenour Iron Mining Company, Little York, and Philadelphia, Pa.; Edward P. Carpenter, James M. Richmond and Henry B. Fowler, corporators; Capital, $200,000. To mine, mill, sell and buy iron ores and the manufacturing of iron, &c., in Hunterdon Co.

Empire Sugar Manufacturing Company, Newark; Charles C. Miller, Andrew Albright and Samuel T. Williams corporators; Capital, $120,000. To manufacture and sell sugar, sugar glucose, starch, corn, &c.

Hudson Tunnel Construction Company, Jersey City; Trenor W. Park, Darius O. Mills, Charles G. Francklyn, and others, corporators; Capital, $2,000,000. To build or construct tunnels, railroads, etc., under the Hudson River, between the States of New Jersey and New York.

Railway Improvement Company of North America, Walton; James O. Bloss, Joseph E. Brister, George S. Coleman, corporators; Capital, $500,000. To construct and operate railroads, bridges, elevators, telegraphs and steamships, and to manufacture and supply rolling stock, equipments, materials, etc., for the same.

Belt Line Construction Company, Jersey City and New York; Henry M. Alexander, William M. Barnum, Allan McCulloh and others, corporators; Capital, $3,000,000. The constructing, finishing, improving and equiping of railways, bridges, works, &c.

Pennsylvania Underground Electric Company Camden; Walter B. Murdoch, William W. Weigley, Samuel M. Hyneman, and others, corporators; Capital, $1,000,000. To manufacture and sell machinery, machines, conduits and tubes for underground telegraphic, telephonic and electrical cables, wires, &c.

NEW YORK.

Suspension Car Truck Manufacturing Company, New York; J. W. Chisholm, Grinnell Burt, Dan'l P. Halstead, G. A. Hobart, Theo. Houston, Thos. W. Pierce, and others, corporators; Capital, $10,000,000. To manufacture, use, let or sell, car trucks and trucks for locomotive engines; also to manufacture, own, let, sell and maintain locomotives, cars, rolling stock and machinery.

The Davis Improved Wrought Iron Wagon Wheel Company, Elmira, N.Y.; Sidney Sweet, C. W. Richardson, Robt. W. Davis, and others, corporators; Capital, $100,000. To manufacture and sell Davis wrought iron wagon wheels and steel buggy wheels, and other articles.

Improved Venetian Shade Company, Lockport; Nathaniel Lerch, Henry Mullett, Amos W. Palmer, and others, corporators; Capital, $16,000. To manufacture and sell the improved venetian shade boxes, brackets, rules, labels, tags, etc.

Universal Heating and Illuminating Company, New York; D. M. Small, W. Terriberry and H. G. Small, corporators; Capital, $1,500,000. To manufacture and sell devices for enriching or producing heating or illuminating gases together, with suitable burners therefor, and apparatus for radiating the heat therefrom.

Watertown Match Company, Limited, Watertown, N. Y.; Owen G. Staples, J. F. Moffett, Isaac Munson, and others, corporators; Capital, $100,000. To manufacture and sell matches.

New York Glaciarum Company, New York; Geo. A. Sherridan, James A. Hudson and Oscar S. Strauss, corporators; Capital, $500,000. To manufacture and sell ice-making machines, and refrigerating machines, and parts of same.

ILLINOIS.

Chicago and Southeastern Railway Company, Chicago; John L. Beveridge, Eugene Ellery, David B. Dewey, Alonzo Schrader and Robt. R. Kendall, corporators; Capital, $700,000. To construct and operate a line of railway from Chicago, Cook County, to a point on the boundry line between the States of Illinois and Indiana, in the County of Kankakee, or the County of Iroquois, in the State of Illinois, running through Will County.

Chicago Railway Transfer Company, Chicago; Victor D. Gowen, Chas. Roberts, Francis A. Riddle, Richard Gregg and Stephen L. Inslee, corporators; Capital, $500,000. To construct and operate a line of railroad from a point near South Chicago, in the Township of Hyde Park; thence through the Townships of Hyde Park, Lake, Calumet, Lyons, Cicero, Jefferson and Lake View to a point in said Township of Jefferson or Lake View, County of Cook, State of Illinois.

Chicago, Keokuk and Kansas City Railway Company, Chicago; Chas. C. P. Holden, J. Marvin Davis, William N. Reynolds, Jos. S. Raynolds, Wright Halden, Whitney T. Press and Richard Riley, corporators; Capital, $3,500,000. To construct and operate a line of railroad from the City of Chicago, Ills., thence, southwesterly through the State aforesaid, to the City of Hamilton, in Hancock County, in said State, with the right and authority to build a branch to Hannibal, Ills.; also a branch to be called the Indiana branch, and a branch to be called the Rock Island Branch.

The National Cylinder Company, Chicago; Edward W. Wolher, Arthur S. Wright and John F. Temple, corporators; Capital, $75,000. The manufacture and sale of enameled cylinders for wood and metal pumps, and enameled water pipes, and doing a general manufacturing and jobbing business in the materials used in manufacturing wood and iron pumps.

The Duluth Lumber Company, Chicago; Robt. L. Henry, Sam'l K. Martin and Henry S. Osborne, corporators; Capital, $300,000. To manufacture and sell lumber in all its branches.

The Abbott Buggy Company, Chicago; A. A. Abbott, C. H. Bunker and Albert H. Veeder, corporators; Capital, $150,000. The manufacture and sale of carriages, sleighs and runners.

The National Drying Company, Chicago; Alfred Edwards, Jas. C. Caldwell and John Gubbins, corporators; Capital, $100,000. The manufacture and sale of machines for drying brewers grains, glucose meals, abbattoir, and other materials.

The National Construction Co., East St. Louis; Jos. A. Hall, Henry N. Samstag and Michael Kinealy, corporators; Capital, $100,000. To construct bridges, railroads and buildings, and other improvements on contract.

Gipps Brewing Company, Peoria; John M. Gipps, W. H. Ballance and Leslie Robison, corporators; Capital, $150,000. For the purpose of carrying on the malting and brewing business.

Rockford Sewing Machine Co., Rockford; J. W. Corey, Levi Rhoades and Henry W. Price, corporators; Capital, $100,000. The manufacture and sale of sewing machines, and parts of the same, and the manufacture and sale of machinery tools and appliances used in making sewing machines, etc.

Machinists' and Engineers' Supplies.

NEW YORK, Nov 24, 1881.

The activity which has characterized the supply market for the past few months does not lessen, but continues unabated. A large portion of the boilers, engines, pipe, fittings and machine tools are for the various electric light companies. In fact, they have created an enormous demand for almost every kind of supplies.

The Henry R. Worthington Hydraulic Works, of Brooklyn, N. Y., offices at 239 Broadway, New York, have issued a new illustrated catalogue of 26 pages, containing illustrations and descriptions of the various improved pumping machines manufactured at their works.

Peter Wright Anvils have advanced to 10¾c. and 11¼c. per pound. Trenton Anvils, 10¾c. per pound.

The American Vise and Tool Association have withdrawn all quotations from the market for the present.

Iron and Metal Review.

The Pig Iron Market has gained rather than lost in strength, notwithstanding the sales may have been somewhat lighter during the last week than the one previous. Prices, although unchanged, still tend upward. We quote as follows:

Foundry No. 1, $25 to $26; Foundry No. 2 X, $23 to $23.50; Gray Forge, $22.50. The demand for Foreign Iron continues equal to the supply, with prices as follows: Gartscherrie, $25 to $26; Coltness, $26 to $26.50; Glengarnock, $25; Carnbroe, $24; Eglinton, $23.

The active increased demand for Steel and Iron Rails continues with prices unchanged at $60 for Steel delivered next year and Iron at $48 to $50. The market for old rails is fair. We quote old T rails at $29 to $29.25 and Double Heads at $31.50 to $32. The demand for Wrought Iron Scrap is good, and the supply scarce. No. 1 is quoted $32.50 for prime selected from yard. The demand for manufactured iron is not as active as last reported but sales are fair and satisfactory, Copper is in fair demand at 18¼c. to 18½c. for Lake Superior. Straits Tin 22 ¾c. to 22½c.; Australian 22⅝c.; and Billiton, 20½c. Lead, 5c. to 5¼c. Spelter, Western, 5⅜c.; Silesian, 6c.; Antimony, 13c. for American and 14½c. to 15c. for Cookson.

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Wanted-Situation: Can build you Lathe or Planer, Large or Small, with such tools as you may have. Address, Machinist. Box 6, care AMERICAN MACHINIST, 96 Fulton St., N. Y.

Wanted—Position, by a Marine Engineer of 21 years' experience, as chief engineer or superintendent of machinery of a mill or factory. Would prefer the West. Address BOX 12, AMERICAN MACHINIST office.

Inventors desiring parties of capital and experience to manufacture and introduce their inventions, please address, W., care AMERICAN MACHINIST.

Wanted.—A Second-hand Automatic Cut-off Engine, about 50 horse power. Must be in good condition. Send full details, with price, to Box One, AMERICAN MACHINIST, 96 Fulton St., N. Y.

A thoroughly competent and experienced steam engineer wants a situation of responsibility, with compensation corresponding to the degree of service rendered. Can furnish every required evidence of ability and reliability. Address, "Chief Engineer," office AMERICAN MACHINIST.

A Marine Chief Engineer, of an extensive experience, wishes a situation to run an engine, or take charge of the steam heating apparatus of a building. Is capable of handling all kinds of steam apparatus and do his own repairs. Best of references. Address R. L., BOX 12, Office AMERICAN MACHINIST, 96 Fulton Street, New York.

Situation by a Mechanical Engineer and Draughtsman. Specialties, new machinery and machine tools. First class New England references. Address, C, AMERICAN MACHINIST Office, 96 Fulton Street, N. Y.

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For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 38 John Street, New York.

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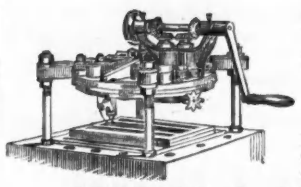

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Descriptive Circular on application.
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FROM 5 TO 30 TONS.
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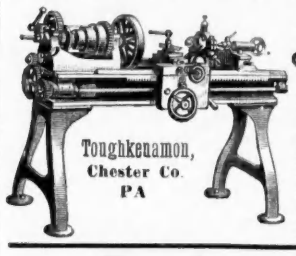

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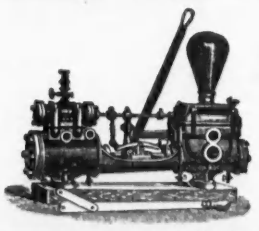

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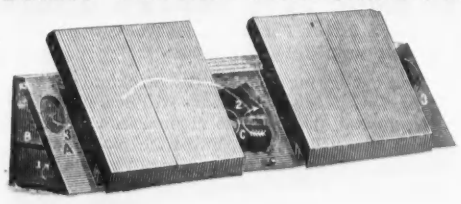

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Manufactured by
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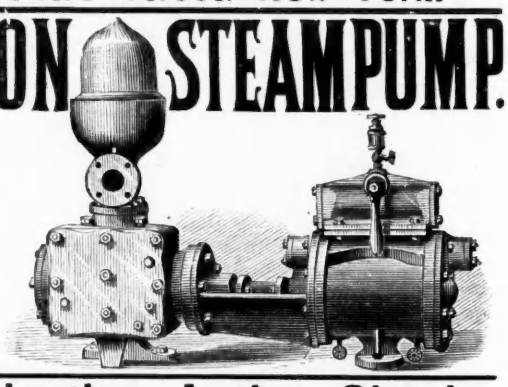

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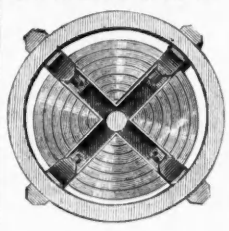

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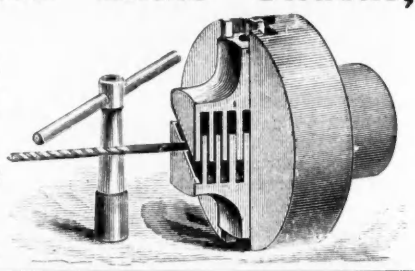

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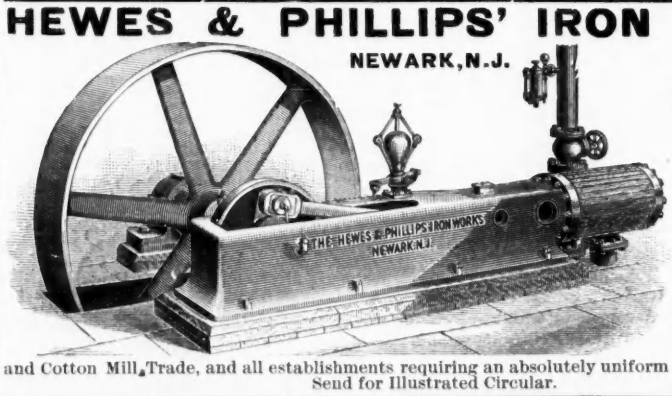

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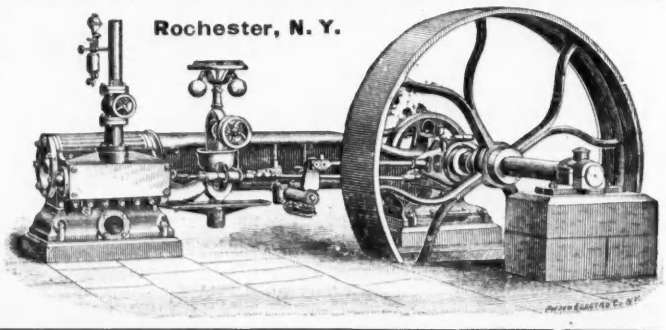

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